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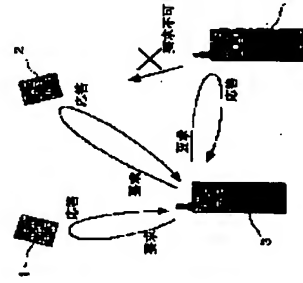
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(54) RADIOCOMMUNICATION DEVICE AND ITS CONTROL METHOD, STORAGE MEDIUM AND COMPUTER PROGRAM

(57)Abstract:

PROBLEM TO BE SOLVED: To prevent interference between mutual radio tag readers/writers.

SOLUTION: The function equal to a radio tag is added to the radio tag readers/writers so that the radio tag readers/writers themselves can behave as the radio tag to a request from the other radio tag readers/writers. When receiving a sleep request from an external radio tag reader/writer, the active signal transmission in the radio tag readers/writers is prohibited by interlocking with prohibition of the passive signal transmission in the radio tag to reduce interference of a request signal between the



other radio tag readers/writers.

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CLAIMS

[Claim(s)]

[Claim 1] It is the radio communication equipment which is a radio communication equipment which transmits and receives wireless data, is equipped with the passive communications department which returns the reply signal over this while receiving the demand signal from the outside, and the active communications department which

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receives the reply signal over this while transmitting a demand signal outside, and is characterized by the thing said passive communications department answers having received the sleep demand signal, lapse into sleeping, and it stops answering a demand signal for from the outside.

[Claim 2] Said passive communications department is a radio communication equipment according to claim 1 characterized by what sleeping is canceled according to having received the sleep discharge demand signal, and the response to the demand signal from the outside is resumed for.

[Claim 3] Between sleeping and for said active communications department, said passive communications department is the radio communication equipment according to claim 1 with which it is characterized by what transmission of a demand signal is forbidden for.

[Claim 4] It is the radio communication equipment according to claim 1 which said active communications department is a wireless tag reader which modulates a demand signal and is sent out as an electric wave of predetermined transmit frequencies, and is characterized by what said passive communications department is a wireless tag which recognizes the demand signal received from the outside in the state of non-contact.

[Claim 5] Said active communications department is a radio communication equipment according to claim 1 which is the IC card reader which receives a reply signal, applying a modulation to the signal which appears according to the load effect between the antennas in said passive communications department, and is characterized by what said passive communications department is an IC card to which the load between own antennas is changed according to the reply signal over the demand signal from the outside.

[Claim 6] With the passive communications department which returns the reply signal over this while receiving the demand signal from the outside It has the active communications department which receives the reply signal over this while transmitting a demand signal outside. The control approach of the radio communication equipment characterized by what it has for the step to which are the control approach of the radio communication equipment which transmits and receives wireless data, and said passive communications department lapses into sleeping, and stops answering having received the sleep demand signal and answering a demand signal from the outside.

[Claim 7] The control approach of the radio communication equipment according to claim 6 characterized by what it has further for the step which said passive

communications department cancels sleeping according to having received the sleep discharge demand signal, and resumes the response to the demand signal from the outside.

[Claim 8] The control approach of the radio communication equipment according to claim 6 characterized by what it has further for the step which said passive communications department forbids transmission of the demand signal by said active communications department between sleeping.

[Claim 9] It is the control approach of the radio communication equipment according to claim 6 which said active communications department is a wireless tag reader which modulates a demand signal and is sent out as an electric wave of predetermined transmit frequencies, and is characterized by what said passive communications department is a wireless tag which recognizes the demand signal received from the outside in the state of non-contact.

[Claim 10] Said active communications department is the control approach of the radio communication equipment according to claim 6 characterized by what is been the IC card to which the load between own antennas is changed according to a reply signal [as opposed to / are the IC card reader which receives a reply signal, applying a modulation to the signal which appears according to the load effect between the antennas in said passive communications department, and / the demand signal from the outside in said passive communications department].

[Claim 11] With the passive communications department which returns the reply signal over this while receiving the demand signal from the outside It is the storage which stored physically the computer software described to perform control of the radio communication equipment equipped with the active communications department which receives the reply signal over this while transmitting a demand signal outside on computer system in the computer-readable format. The step which it answers that said computer software received the sleep demand signal, and said passive communications department lapses into sleeping, and is answered and made into a demand signal from the outside, The step which said passive communications department cancels sleeping and makes resume the response to the demand signal from the outside according to having received the sleep discharge demand signal. The storage characterized by providing the step which said passive communications department forbids transmission of the demand signal by said active communications department between sleeping.

[Claim 12] With the passive communications department which returns the reply signal over this while receiving the demand signal from the outside It is the computer

program described to perform control of the radio communication equipment equipped with the active communications department which receives the reply signal over this while transmitting a demand signal outside on computer system. The step which it answers having received the sleep demand signal, and said passive communications department lapses into sleeping, and is answered and made into a demand signal from the outside. The step which said passive communications department cancels sleeping and makes resume the response to the demand signal from the outside according to having received the sleep discharge demand signal. The computer program characterized by providing the step which said passive communications department forbids transmission of the demand signal by said active communications department between sleeping.

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DETAILED DESCRIPTION

[Detailed Description of the Invention]

[0001]

[Field of the Invention] This invention relates to the radio communication equipment which performs a non-contact communication link using a wireless tag with the operating characteristic which sends the electric wave which answers having started the radio communication equipment which operates comparatively in the radio area of a short distance and its control approach, the storage, and the list at the computer program, for example, having received the electric wave of a specific frequency, and is equivalent to identification information or the information memorized and its control approach, a storage, and a list at a computer program.

[0002] Furthermore, in detail, this invention relates to the radio communication

equipment which equips a wireless tag, and a wireless tag reader / writer ability and its control approach, a storage, and a list at a computer program, and relates to the radio communication equipment which prevents interference of a wireless tag reader / writers in the environment where two or more wireless tags, and a wireless tag reader / writer are intermingled in the same radio area and its control approach, a storage, and a list at a computer program.

[0003]

[Description of the Prior Art] The radio frequency identification unit (wireless tag) of current and a non-contact mold is used by many systems, such as an unapproved carrying-out prevention system in dealers, such as a system of tariff liquidation in the system which manages close leaving, the goods discernment system in the PD, a dining-room, etc., CD, and software.

[0004] A wireless tag can specify what it is a device including the identification information of a proper, or the storage region which can be written, and it is by reading the information which has the operating characteristic which sends the electric wave which answers having received the electric wave of a specific frequency and is equivalent to identification information or the information memorized, and is written in the identification information and the storage region of a wireless tag by the reader side. Therefore, in the system using the information currently written in the identification information and the storage region of a wireless tag, distinction of goods, an owner's distinction, etc. can be performed using ID of a proper and the information on other which are written in.

[0005] For example, it is indicated by JP.6-123773.A about the radio frequency identification unit which package-izes IC chip equipped with transmission and reception and a memory function, the driving source of this chip, and an antenna, and is manufactured small. While according to this radio frequency identification unit transmitting various data about goods etc. to the receiving means of IC chip via an antenna and accumulating that output in memory, the data in memory can be read if needed and it can supply outside on radio through an antenna. Therefore, it is possible to check existence of goods etc. and a location quickly and easily, or to pursue.

[0006] By the way, in the same radio area, the equipment with which such wireless tag system performs reading or the writing to a wireless tag fundamentally is designed on the assumption that there is only one. For this reason, under the environment where two or more wireless tags, and a wireless tag reader / writer are intermingled in the same radio area, it interferes each other and good radio cannot be performed.

[0007] For example, to access from one a wireless tag reader / writer, two or more

wireless tags may answer, or two or more wireless tag reader / writers may try access to the same wireless tag.

[0008] for example, in the ** table No. 513841 [2000 to] official report When answering appeal from one RF/ID reader, in order that two or more RF/ID tags may solve the problem of colliding mutually A tag with a different bitwise response from the response as which bitwise was determined beforehand is deactivated (deactivate). By activating alternatively a tag with the response as which bitwise was determined beforehand (activate), it is indicated about the approach and equipment for a RF discernment tag which are clearly obtained from two or more tags.

[0009] The problem that the response from a wireless tag will interfere mutually is avoidable by making the wireless tag which the reader/writer of a wireless tag does not make the partner of access be deactivated or sleep as proposed in this official report.

[0010] However, case [like a wireless tag with a reader/writer function which was mentioned above], even if the situation in which a wireless tag will be in sleeping and a response interferes each other is avoidable, the problem that the demand from the reader/writer function will interfere with other reader/writers is still left behind.

[0011] Probably, the problem of interference of the communication link in such same radio area is applied also in a well-known IC card and IC card reader/writer as non-contact communication system. An IC card communicates by applying amplitude modulation to the signal which appears in the receiving circuit of reader/writer by changing the load between own antennas according to the reply signal over the question signal from reader/writer.

[0012]

[Problem(s) to be Solved by the Invention] The purpose of this invention is to provide the outstanding radio communication equipment which performs a non-contact communication link using a wireless tag with the operating characteristic which sends the electric wave which answers having received the electric wave of a specific frequency and is equivalent to identification information or the information memorized and its control approach, a storage, and a list with a computer program.

[0013] The further purpose of this invention is to provide with a computer program the outstanding radio communication equipment which equips the both sides of a wireless tag, and a wireless tag reader / writer ability, and operates suitably in radio area and its control approach, a storage, and a list.

[0014] The further purpose of this invention is to provide with a computer program the outstanding radio communication equipment which can prevent interference of a

wireless tag reader / writers in the environment where two or more wireless tags, and a wireless tag reader / writer are intermingled in the same radio area and its control approach, a storage, and a list.

[0015]

[Means for Solving the Problem and its Function] This invention is made in consideration of the above-mentioned technical problem. The 1st side face With the passive communications department which is the radio communication equipment which transmits and receives wireless data, and returns the reply signal over this while receiving the demand signal from the outside Having the active communications department which receives the reply signal over this, while transmitting a demand signal outside, said passive communications department is a radio communication equipment characterized by the thing answer having received the sleep demand signal, lapse into sleeping, and it stops answering a demand signal for from the outside.

[0016] With moreover, the passive communications department which returns the reply signal over this while the 2nd side face of this invention receives the demand signal from the outside It has the active communications department which receives the reply signal over this while transmitting a demand signal outside. It is the control approach of the radio communication equipment which transmits and receives wireless data, and is the control approach of the radio communication equipment characterized by what it has for the step to which answer having received the sleep demand signal, and said passive communications department lapses into sleeping, and stops answering a demand signal from the outside.

[0017] According to the radio communication equipment concerning the 1st or 2nd side face of this invention, or its control approach, even if it is a case so that two or more radio communication equipments may be intermingled in the same radio area, the reply signal from two or more passive communications departments which receive the same demand signal can interfere, and a certain thing can be avoided.

[0018] Said passive communications department cancels sleeping according to having received the sleep discharge demand signal by sleeping, and the response to the demand signal from the outside is resumed.

[0019] Moreover, as for said active communications department, transmission of a demand signal is forbidden for said passive communications department between sleeping. Therefore, even if it is a case so that two or more radio communication equipments may be intermingled in the same radio area, the demand signal from the mutual active communications department can interfere, and a certain thing can be avoided.

[0020] Here, said active communications department can constitute as a wireless tag reader which modulates a demand signal and is sent out as an electric wave of predetermined transmit frequencies. Moreover, said passive communications department can constitute as a wireless tag which recognizes the demand signal received from the outside in the state of non-contact.

[0021] That is, the wireless tag reader itself can carry out behavior as a wireless tag to the demand from other wireless tag readers by adding a function equivalent to a wireless tag to a wireless tag reader. In such a case, when a sleep demand is received from an external wireless tag reader, the radio communication equipment concerning the 1st side face of this invention can be interlocked with forbidding the passive signal transmission in a wireless tag, and can mitigate interference of a demand signal among other wireless tag readers by forbidding the active signal transmission in a wireless tag reader.

[0022] Or said active communications department can constitute as an IC card reader which receives a reply signal, applying a modulation to the signal which appears according to the load effect between the antennas in said passive communications department. Moreover, said passive communications department can constitute as an IC card to which the load between own antennas is changed according to the reply signal over the demand signal from the outside.

[0023] In such a case, when a sleep demand is received from an external IC card reader, the radio communication equipment concerning the 1st side face of this invention can be interlocked with forbidding the passive signal transmission in an IC card, and can mitigate interference of a demand signal among other IC card readers by forbidding the active signal transmission in an IC card reader.

[0024] With moreover, the passive communications department which returns the reply signal over this while the 3rd side face of this invention receives the demand signal from the outside It is the storage which stored physically the computer software described to perform control of the radio communication equipment equipped with the active communications department which receives the reply signal over this while transmitting a demand signal outside on computer system in the computer-readable format. The step which it answers that said computer software received the sleep demand signal, and said passive communications department lapses into sleeping, and is answered and made into a demand signal from the outside, The step which said passive communications department cancels sleeping and makes resume the response to the demand signal from the outside according to having received the sleep discharge demand signal. Said passive communications department

is the storage characterized by providing the step which forbids transmission of the demand signal by said active communications department between sleeping.

[0025] The storage concerning the 3rd side face of this invention is a medium which offers computer software in a computer-readable format to the general purpose computer system which can perform various program codes, for example, Attachment and detachment of DVD (Digital Versatile Disc), CD (Compact Disc), FD (FloppyDisk), MO (Magneto-Optical disc), etc., etc. are free for such a medium, and it is a storage of portability. Or it is also technically possible to provide specific computer system with computer software via transmission media, such as a network (for a network not to ask distinction of wireless and a cable), etc.

[0026] The storage concerning the 3rd side face of this invention defines the collaboration--relation on the structure of the computer software and the storage for realizing the function of computer software predetermined in a computer system top, or a function. If it puts in another way, by installing predetermined computer software in computer system through the storage concerning the 3rd side face of this invention, on computer system, a collaboration-operation is demonstrated and the same operation effectiveness as the radio communication equipment concerning each 1st [of this invention] and 2nd side faces or its control approach can be acquired.

[0027] With moreover, the passive communications department which returns the reply signal over this while the 4th side face of this invention receives the demand signal from the outside It is the computer program described to perform control of the radio communication equipment equipped with the active communications department which receives the reply signal over this while transmitting a demand signal outside on computer system. The step which it answers having received the sleep demand signal, and said passive communications department lapses into sleeping, and is answered and made into a demand signal from the outside, The step which said passive communications department cancels sleeping and makes resume the response to the demand signal from the outside according to having received the sleep discharge demand signal. Said passive communications department is the computer program characterized by providing the step which forbids transmission of the demand signal by said active communications department between sleeping.

[0028] The computer program concerning the 4th side face of this invention defines the computer program described to realize processing predetermined in a computer system top in the computer-readable format. If it puts in another way, by installing the computer program concerning the 4th side face of this invention in computer system, on computer system, a collaboration-operation is demonstrated and the same

operation effectiveness as the radio communication equipment concerning each 1st [of this invention] and 2nd side faces or its control approach can be acquired.

[0029] The purpose, the description, and advantage of further others of this invention will become [rather than] clear by detailed explanation based on the operation gestalt and the drawing to attach of this invention mentioned later.

[0030]

[Embodiment of the Invention] Hereafter, it explains in detail about the operation gestalt of this invention, referring to a drawing.

[0031] The situation of radio area which realized this invention is shown in drawing 1. In this radio area, two or more reader/writer equipments are intermingled in two or more wireless tags and a list. In this drawing, reference numbers 1 and 2 are wireless tags, and reference numbers 3 and 4 are a wireless tag reader / writer. Hereafter, when you only call it "a wireless tag reader / writer", suppose that it is the radio communication equipment equipped with a wireless tag and the both sides of a reader/writer function.

[0032] In the example shown in drawing 1, read-out or a write request is transmitted to the wireless tags 1 and 2 with which a wireless tag reader / writer 3 exists in the same radio area, and a list to a wireless tag reader / writer 4, and signs that the response is received are shown. In this case, if it sees from a wireless tag reader / writer 3, a wireless tag reader / writer 4 will act like the wireless tags 1 and 2. That is, a wireless tag reader / writer 3 also recognizes a wireless tag reader / writer 4 as one of the wireless tags.

[0033] Furthermore, in the example shown in this drawing, in order to mitigate the interference to a wireless tag reader / writer 3, the wireless tag reader / writer 4 has controlled sending out a sending signal active as reader/writer.

[0034] The hardware configuration of the radio communication equipment 100 equipped with the function of a wireless tag and the both sides of reader/writer is typically shown in drawing 2. Hereafter, each part is explained, referring to this drawing.

[0035] A reference number 101 is a non-volatile storage region, for example, consists of nonvolatile memory equipment in which writing like EEPROM (Electrically Erasable and Programmable ROM) is possible, and external storage like hard disk equipment. This non-volatile storage region 101 is equipped with the usable storage region general-purpose [the control-software storing field holding the program code for controlling actuation of a radio communication equipment 100, the virtual tag storage region used when a radio communication equipment 100 acts as a wireless tag (or

other passive communication devices), and others].

[0036] A reference number 102 is a display with an output screen, for example, consists of liquid crystal display displays (LCD), and it is used in order to display actuation of a radio communication equipment 100 and a condition.

[0037] A reference number 103 is CPU (Central Processing Unit) which controls actuation of the radio-communication-equipment 100 whole in generalization.

Moreover, a reference number 104 is temporary storage 104, and consists of volatile memory equipment in which rewriting like RAM (Random Access Memory) is possible. CPU103 performs the program code loaded on temporary storage 104 from the control-software storing field of the non-volatile storage region 101, and saves the activity data under program execution in temporary storage 104 temporarily.

[0038] A reference number 105 is the input section for a user to input an actuation command, data, etc. The input section 105 consists of two or more keys, a carbon button, or a touch panel on which the display screen of a display 102 was overlapped.

[0039] A reference number 106 is the Radio Communications Department, is a functional module which performs the exterior and radio according to the command from CPU103, and is equipped with RF block which transmits and receives the baseband block which manages transmission and reception of a signal, and predetermined RF signalling frequency through an antenna 107. The Radio Communications Department 106 can consist of general-purpose logic devices like FPGA (Field Programmable Gate Array) into which a user can change internal logic by the program after IC completion.

[0040] With this operation gestalt, the Radio Communications Department 106 has the passive communication facility which receives the demand signal from the outside and returns a reply signal, and the active communication facility which receives the reply signal from the exterior while transmitting a demand signal outside. However, the after-mentioned is yielded about these details.

[0041] A reference number 108 is an external interface, and it can be used in order to connect a radio communication equipment 100 with a computer, other information machines and equipment, and an information processing terminal. An external interface is Ethernet, RS232C, and USB (Universal Serial Bus), IrDA, Bluetooth and IEEE. It can constitute from standard interfaces, such as 802.11b.

[0042] The functional configuration of the Radio Communications Department 106 is typically shown in drawing 3. As shown in this drawing, it has passive communications department 106A which receives the demand signal from the outside and returns a reply signal, and active communications department 106B which receives the reply

signal from the exterior while transmitting a demand signal outside.

[0043] Passive communications department 106A can be read from the exterior, and can receive demand signals, such as a demand, and a sleep demand besides a write request, a sleep discharge demand. When a read-out demand is received, a letter is answered in the requested data stored in the virtual tag storage region of the non-volatile storage region 101. Moreover, when a write request is received, requested data is written in the virtual tag storage region of the non-volatile storage region 101.

[0044] Moreover, passive communications department 106A answers having received the sleep demand, and lapses into sleeping. It stops answering a read-out demand and a write request from the outside in sleeping. For example, when two or more passive communications department 106A in the same radio area is intermingled, the problem that the response from passive communications department 106A will interfere mutually can be avoided by setting it except specific passive communications department 106A as sleeping. Sleeping is continued until it receives a sleep discharge demand and sleep is canceled.

[0045] Passive communications department 106A holds any of an own condition, i.e., sleeping, or a sleep discharge condition they are to condition attaching part 106C.

Active communications department 10B can access condition attaching part 106C of passive communications department 106A.

[0046] One active communications department 106B can receive the reply signal over this while it is read outside and transmits demand signals, such as a demand, and a sleep demand besides a write request, a sleep discharge demand. By transmitting a sleep demand, the sleeping can be canceled by making the other party's passive communications department 106A change to sleeping, and transmitting a sleep discharge demand.

[0047] Active communications department 10B distinguishes whether passive communications department 106A is sleeping with reference to condition attaching part 106C in passive communications department 106A, before transmitting a demand signal. And if it is sleeping, sending out of a demand signal will be disabled. this — for example, when two or more active communications department 10B is intermingled in the same radio area, the problem that a demand signal will interfere mutually can be avoided.

[0048] A wireless tag with the operating characteristic which sends the electric wave which answers having received the electric wave of a specific frequency as an example of the combination of passive communication facility and active

communication facility, and is equivalent to identification information or the information memorized, and a wireless tag reader / writer can be mentioned.

[0049] Here, the structure to which the wireless tag reader / writer as the active communications department carry out R/W actuation to the wireless tag as the passive communications department is explained, referring to drawing 4. a wireless transmission and reception in the example of illustration sake — electromagnetism — the transfer method is adopted.

[0050] In this drawing, a reference number 11 is a wireless tag and consists of a tag chip 12 and an antenna 13.

[0051] The dipole antenna of the half-wave length etc. is used for an antenna 13. Moreover, the tag chip 12 consists of the modulation section 20, the rectification / recovery section 22, and the memory section 23. The memory section 23 is equivalent to a virtual tag storage region (above-mentioned).

[0052] It is received by the antenna 13 and the electric wave fo transmitted from the wireless tag reader / writer 10 is inputted into rectification / recovery section 22.

Here, a recovery function carries out initiation of operation according to this power source, and it is recognized that it is a reading signal over the wireless tag 11 at the same time an electric wave fo is rectified and it is changed into DC power supply. The generated power source is supplied also to the memory section 23 and the modulation section 20.

[0053] The memory section 23 reads information, such as ID beforehand stored in the interior, and sends it to the modulation section 20 as transmit data. The modulation section 20 consists of diode switches 21, and a diode switch 21 repeats ON / off actuation with transmit data. That is, when data are 1, it becomes ON and termination of the antenna 13 is carried out with an antenna impedance (for example, 50 ohms).

[0054] At this time, the electric wave from a wireless tag reader / writer 10 is absorbed by the wireless tag 11 side. When data are 0, it becomes off, and a diode switch 21 will be in an opening condition, and the termination of an antenna 13 will also be in an opening condition at coincidence. At this time, it will be reflected and the electric wave from a tag reader / writer 10 will return to a transmitting agency.

[0055] Such a correspondence procedure is called a "back-scatter method." In this way, the wireless tag 11 becomes possible [sending the information on internal to wireless tag reader / writer 10 side with a non-power source].

[0056] One wireless tag reader / writer 10 consist of antennas 15 connected to the tag reading module 14 and this tag reading module 14, and is used, connecting with the host device 16. The host device 16 consists of information terminals, such as CPU103

in a radio communication equipment 100, a personal computer further connected by external-interface 108 course, and PDA (Personal Digital Assistant), and offers a user interface for a user to perform a dialogue input.

[0057] The host device 16 notifies reading directions of the wireless tag 11 to the communications control section 30 via the host interface section 31 first.

[0058] The baseband processing section 29 sends baseband signaling to the ASK (Amplitude Shift Keying) modulation section 27, after filtering by editing into transmit data, if the reading command of the tag from the communications control section 30 is received. The ASK modulation section 27 performs an ASK modulation on the frequency of a frequency synthesizer 26.

[0059] The frequency setting of a frequency synthesizer 26 is performed by the communications control section 30. Generally, for mitigation of the standing wave of the signal from the wireless tag 11, or a multi-pass, the hopping of the transmit frequencies to the wireless tag 11 is carried out, and they are used. Directions of this hopping are also performed by the communications control section 30. The sending signal to which the ASK modulation was applied is emitted towards the wireless tag 11 via a circulator 24 from an antenna 15.

[0060] As stated previously, the reflective signal from the wireless tag 11 which has returned by the back-scatter method is the same frequency as the signal transmitted from the wireless tag reader / writer 10. It is received by the antenna 15 of a wireless tag reader / writer 10, and this signal is inputted into a mixer 25.

[0061] Since the same local frequency f_0 as the time of transmission is inputted into a mixer 25, in the output of a mixer 25, the signal to which the modulation was applied by the wireless tag 11 side will appear.

[0062] In the recovery section 28, it recovers from this signal to the data of 1/Q, and sends to the baseband processing section 29. In the baseband processing section 29, data are decoded and the data stored in the memory section 23 in the wireless tag 11 are taken out. This data is transmitted to the host device 16 from the host interface section 31 according to directions of the communications control section 30.

[0063] A wireless tag reader / writer 10 can read the information in the wireless tag 11 as mentioned above. Moreover, a wireless tag reader / writer 10 can perform write-in actuation to the wireless tag 11 in the same actuation as ****. In this case, the data by the side of the host device 16 can be written in the memory section 23 (namely, virtual tag storage region) in the wireless tag 11.

[0064] Moreover, IC card reader/writer can be mentioned to the noncontact IC card list which communicates by applying amplitude modulation to the signal which appears

in the receiving circuit of reader/writer by changing the load between own antennas according to the reply signal over the demand signal from reader/writer as other examples about the combination of passive communication facility and active communication facility.

[0065] Radio between an IC card and IC card reader/writer is realized based on the principle of electromagnetic induction. In drawing 5, the structure of the radio of an IC card and IC card reader/writer based on electromagnetic induction is illustrated notionally. IC card reader/writer is equipped with the antenna LRW which consisted of loop-formation coils, and a field is generated by passing Current IRW at this antenna LRW around it. On the other hand, the loop-formation coil Lc is electrically made with the IC card side around the IC card. In the loop-formation coil Lc edge by the side of an IC card, the induced voltage by the field which the loop antenna Lc by the side of IC card reader/writer emits arises, and it is inputted into the terminal of the IC card connected to the loop-formation coil Lc edge.

[0066] Although the degree of coupling changes according to mutual physical relationship, the loop-formation coil Lc by the side of the antenna LRW by the side of IC card reader/writer and an IC card can be caught if one transformer is formed as a system, and as shown in drawing 6, it can model R/W actuation of an IC card.

[0067] At an IC card reader/writer side, in modulating the current IRW passed at Antenna LRW, the electrical potential difference VO by which induction is carried out to the loop-formation coil Lc on IC chip can receive a modulation, and IC card reader/writer can perform data transmission to an IC card using that.

[0068] Moreover, an IC card has the function (Load Switching) to fluctuate the load between the terminals of the loop-formation coil Lc according to the data for returning IC card reader/writer. If the load between the terminals of the loop-formation coil Lc is changed, in an IC card reader/writer side, the impedance between antenna terminals changes, and it will become fluctuation of the passage current IRW of Antenna LRW, or an electrical potential difference VRW, and will appear. By restoring to a part for this fluctuation, IC card reader/writer can receive the return data of an IC card.

[0069] Namely, an IC card can communicate by applying amplitude modulation to the signal which appears in the receiving circuit by the side of card R/W equipment by changing the load between own antennas according to the reply signal over the demand signal from IC card reader/writer.

[0070] In the form of the flow chart shows the signal reception actuation in a radio communication equipment 100 to drawing 7. A radio communication equipment makes

possible behavior as passive communication facility like the usual wireless tag (or IC card), and this actuation is realized with the gestalt of performing the control software with which CPU103 is stored in the non-volatilized storage region 101. Or it is also possible to realize by the logic mounted in the baseband block in the Radio Communications Department 106 constituted by FPGA etc. Hereafter, the signal reception in a radio communication equipment 100 is explained, referring to this flow chart.

[0071] If signal reception starts in a radio communication equipment 100, in step S1, sleeping will be initialized off first. And it will be in the condition of the waiting for signal reception at step S2 after this.

[0072] In a signal receiving waiting state, if a radio communication equipment 100 receives a reply signal from passive communication facility, such as an external wireless tag (or IC card), or receives a demand signal from active reception functions, such as a wireless tag reader / writer (or IC card reader/writer), it will progress to step S3 and sleeping will be judged.

[0073] In the decision block S3, when judged with sleeping being ON, it progresses to step S4 and judges whether the signal received further is a sleep discharge demand. In the case of signals other than a sleep discharge demand, the radio communication equipment 100 during sleep waits for return and the next signal reception to step S2, without processing anything.

[0074] On the other hand, when judged with it being a sleep discharge demand in step S4, after progressing to degree step S5 and setting up sleeping off, it waits for return and the next signal reception to step S2.

[0075] If processing in step S5 is performed, sleeping is canceled, and this radio communication equipment 100 will be in the condition that various demands as a wireless tag reader / a writer (or IC card reader/writer) can be transmitted while being in the condition that it can answer to various demands as passive communication facility, such as a wireless tag (or IC card).

[0076] Moreover, in the decision block S3, when judged with sleeping being off, the signal progressed and received to step S6 judges whether it is a demand signal from active communication facility, such as other wireless tag reader / writers (or IC card reader/writer), or it is a reply signal from passive communication facility, such as other wireless tags (or IC card).

[0077] In the decision block S6, when judged with it being a demand signal from active communication facility, such as other wireless tag reader / writers (or IC card reader/writer), it progresses to step S7 and judges whether an input signal is a sleep

demand further.

[0078] When judged with it being a sleep demand in the decision block S7, after setting sleeping as ON in a degree S8, it waits for return and the next signal reception to step S2.

[0079] If step S8 is processed, this radio communication equipment 100 will not transmit various demands as active communication facility, such as a wireless tag reader / writer (or IC card reader/writer), while stopping answering to various demands as passive communication facility, such as a wireless tag (or IC card), until sleeping is canceled.

[0080] Moreover, in the decision block S7, when judged with an input signal being except a sleep demand, it progresses to step S10 and the Radio Communications Department 106 performs, the behavior, i.e., the demand reception, as passive communication facility, such as a wireless tag (or IC card). Then, it waits for return and the next signal reception to step S2. Drawing 9 explains the demand reception in step S10 separately on the relation of space.

[0081] When it judges that an input signal is not a demand signal from active communication facility, such as other wireless tag reader / writers (or IC card reader/writer), in the decision block S6, namely, when judged with it being a reply signal from passive communication facility, such as other wireless tags (or IC card) it progresses to step S9 and performs, the behavior, i.e., the response reception, as active communication facility, such as a wireless tag reader / writer (or IC card reader/writer). Then, it waits for return and the next signal reception to step S2.

Drawing 8 explains the response reception in step S9 separately on the relation of space.

[0082] In the form of the flow chart shows the procedure of the response reception in step 9 in the flow chart shown in drawing 7 to drawing 8. As for this response reception, a radio communication equipment 100 is equivalent to the behavior as active communication facility, such as a wireless tag reader / writer (or IC card reader/writer). This response reception is realized with the gestalt of performing the control software with which CPU103 is stored in the non-volatilized storage region 101. Or it is also possible to realize by the logic mounted in the baseband block in the Radio Communications Department 106 constituted by FPGA etc. Hereafter, the response reception of a radio communication equipment 100 is explained, referring to this flow chart.

[0083] A radio communication equipment 100 creates a response result after reply signal reception initiation, returns processing to the procedure of call origin (step S21).

and ends response reception.

[0084] Moreover, in the form of the flow chart shows the procedure of the demand reception in step 10 in the flow chart shown in drawing 7 to drawing 9 . As for this demand reception, a radio communication equipment 100 is equivalent to the behavior as passive communication facility, such as a wireless tag (or IC card). This demand reception is realized with the gestalt of performing the control software with which CPU103 is stored in the non-volatilized storage region 101. Or it is also possible to realize by the logic mounted in the baseband block in the Radio Communications Department 106 constituted by FPGA etc. Hereafter, the demand reception of a radio communication equipment 100 is explained, referring to this flow chart.

[0085] First, in step S31, it distinguishes whether the demand which received is ID discernment demand. In being ID discernment demand, it progresses to step S32 and performs ID discernment processing. ID discernment processing is reading ID which passive communication facility's, such as this wireless tag's, has. With this operation gestalt, ID is read from the inside of the virtual tag storage region of the non-volatilized storage region 101, and it is sent out to a requiring agency.

[0086] Moreover, if the demand which received is not ID discernment demand, subsequently in step S34, it will distinguish whether it is a write request. In being a write request, it progresses to step S35 and performs write-in processing. It is writing the demanded information in the demanded location to the virtual tag storage region in the non-volatilized storage region 101 indicated to be write-in processing in this operation gestalt to drawing 2 .

[0087] Moreover, if the demand which received is not a write request, subsequently in step S36, it will distinguish whether it is a read-out demand. In being a read-out demand, it progresses to step S37 and performs read-out processing. It is reading in the demanded size from the location of which the information currently held in the virtual tag storage region in the non-volatilized storage region 101 indicated to be read-out processing in this operation gestalt to drawing 2 was required.

[0088] After processing the demand which these-received, a reply signal is transmitted to a requiring agency at step S33, and this whole manipulation routine is ended.

[0089] Moreover, in the form of the flow chart shows procedure for a radio communication equipment 100 to perform signal transmitting processing to drawing 10 . According to this procedure, in case it acts as active communication facility, such as a wireless tag reader / writer (or IC card reader/writer), transmitting processing of an active demand signal is restricted according to the condition (that is, is it sleeping

or not?) of passive communication facility, such as a wireless tag (or IC card).

[0090] This procedure is realized with the gestalt of performing the control software with which CPU103 is stored in the non-volatilized storage region 101. Or it is also possible to realize by the logic mounted in the baseband block in the Radio Communications Department 106 constituted by FPGA etc. Hereafter, the signal transmitting processing in a radio communication equipment 100 is explained, referring to this flow chart.

[0091] In case a radio communication equipment 100 transmits various demand signals by actuation of the control software stored in the non-volatilized storage region 101, it distinguishes first whether passive communication facility section 106A, such as a wireless tag (or IC card), is sleeping in step S41.

[0092] Since there is no fear of a demand signal interfering mutually among other radio communication equipments when judged with it not being sleeping, it progresses to step S42 and demand signal transmission is performed as it is.

[0093] On the other hand, in the decision block S41, when judged with passive communication facility section 106A, such as a wireless tag (or IC card), being sleeping, in order to restrict signal transmission and to avoid interference with other demand signals, it progresses to step S43, under sleep is set as a response result, and this manipulation routine is ended.

[0094] The demand signal used for the following table 1 between the radio

communication equipments which consist of a wireless tag and wireless tag reader writer equipment is packed. The radio communication equipment 100 in the operation gestalt of this invention mentioned above needs to have at worst the function in which these demand signals can be transmitted. About the demand signal except having been shown here, addition and modification of may be done if needed.

[0095]

[Table 1]

信号名	内容
I D識別要求	周囲の無線タグ、無線タグリーダー・ライター装置が持つI Dを取得するための要求信号。
スリープ要求	周囲の無線タグ、無線タグリーダー・ライター装置に対してスリープ状態にさせるための要求信号。
スリープ解除要求	周囲の無線タグ、無線タグリーダー・ライター装置に対してスリープ状態を解除させるための要求信号。
書き込み要求	周囲の無線タグ、無線タグリーダー・ライター装置に対して情報を書き込むための要求信号。
読み出し要求	周囲の無線タグ、無線タグリーダー・ライター装置から情報を読み出すための要求信号。

[0096] Moreover, the reply signal used for the following table 2 between the radio communication equipments which consist of a wireless tag and wireless tag reader/writer equipment is packed. The radio communication equipment 100 in the operation form of this invention mentioned above needs to have at worst the function in which these reply signals can be transmitted. About the reply signal except having been shown here, addition and modification of may be done if needed.

[0097]

[Table 2]

原番号	内容
I D識別応答	無線タグ、無線タグリーダー・ライター装置が持つI Dを要求元に返すための応答信号。
書き込み応答	無線タグ、無線タグリーダー・ライター装置が持つ記憶領域に情報を書き込んだ結果を返すための応答信号。
読み出し応答	無線タグ、無線タグリーダー・ライター装置が持つ記憶領域から情報を読み出した結果を返すための応答信号。

[0098] It has explained in detail about this invention, referring to a specific operation gestalt more than [addenda]. However, it is obvious that this contractor can accomplish correction and substitution of this operation gestalt in the range which does not deviate from the summary of this invention. That is, this invention should not be indicated with the gestalt of instantiation, and the written contents of this specification should not be interpreted restrictively. In order to judge the summary of this invention, the column of the claim indicated at the beginning should be taken into consideration.

[0099]

[Effect of the Invention] As a full account was given above, according to this invention, the outstanding radio communication equipment which performs a non-contact communication link using a wireless tag with the operating characteristic which sends the electric wave which answers having received the electric wave of a specific frequency and is equivalent to identification information or the information memorized and its control approach, a storage, and a list can be provided with a computer program.

[0100] Moreover, according to this invention, the outstanding radio communication equipment which equips the both sides of a wireless tag, and a wireless tag reader/writer ability, and operates suitably in radio area and its control approach, a storage, and a list can be provided with a computer program.

[0101] Moreover, according to this invention, the outstanding radio communication

equipment which can prevent interference of a wireless tag reader/writers in the environment where two or more wireless tags, and a wireless tag reader/writer are intermingled in the same radio area and its control approach, a storage, and a list can be provided with a computer program.

[0102] According to this invention, in the radio communications system which serves as a wireless tag from a wireless tag reader/writer, wireless tag R/W equipment itself can carry out behavior as a wireless tag to the demand from other wireless tag R/W equipments by adding a function equivalent to a wireless tag to a wireless tag reader/writer. Moreover, when a sleep demand is received from external wireless tag reader/writer, forbidding the passive signal transmission in a wireless tag can be interlocked with, and interference of a mutual demand signal with other wireless tag reader/writers can be mitigated by forbidding the active signal transmission in a wireless tag reader/writer.

[0103] Furthermore, according to this invention, since the above-mentioned effectiveness is acquired without adding modification to especially the wireless specification between a wireless tag, and a wireless tag reader/writer, mounting cost can be reduced sharply.

[Translation done.]

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TECHNICAL FIELD

[Field of the Invention] This invention relates to the radio communication equipment which performs a non-contact communication link using a wireless tag with the operating characteristic which sends the electric wave which answers having started

the radio communication equipment which operates comparatively in the radio area of a short distance and its control approach, the storage, and the list at the computer program, for example, having received the electric wave of a specific frequency, and is equivalent to identification information or the information memorized and its control approach, a storage, and a list at a computer program.

[0002] Furthermore, in detail, this invention relates to the radio communication equipment which equips a wireless tag, and a wireless tag reader / writer ability and its control approach, a storage, and a list at a computer program, and relates to the radio communication equipment which prevents interference of a wireless tag reader / writers in the environment where two or more wireless tags, and a wireless tag reader / writer are intermingled in the same radio area and its control approach, a storage, and a list at a computer program.

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PRIOR ART

[Description of the Prior Art] The radio frequency identification unit (wireless tag) of current and a non-contact mold is used by many systems, such as an unapproved carrying-out prevention system in dealers, such as a system of tariff liquidation in the system which manages close leaving, the goods discernment system in the PD, a dining-room, etc., CD, and software.

[0004] A wireless tag can specify what it is a device including the identification information of a proper, or the storage region which can be written, and it is by reading the information which has the operating characteristic which sends the electric wave

which answers having received the electric wave of a specific frequency and is equivalent to identification information or the information memorized, and is written in the identification information and the storage region of a wireless tag by the reader side. Therefore, in the system using the information currently written in the identification information and the storage region of a wireless tag, distinction of goods, an owner's distinction, etc. can be performed using ID of a proper and the information on other which are written in.

[0005] For example, it is indicated by JP,6-123773,A about the radio frequency identification unit which package-izes IC chip equipped with transmission and reception and a memory function, the driving source of this chip, and an antenna, and is manufactured small. While according to this radio frequency identification unit transmitting various data about goods etc. to the receiving means of IC chip via an antenna and accumulating that output in memory, the data in memory can be read if needed and it can supply outside on radio through an antenna. Therefore, it is possible to check existence of goods etc. and a location quickly and easily, or to pursue.

[0006] By the way, in the same radio area, the equipment with which such wireless tag system performs reading or the writing to a wireless tag fundamentally is designed on the assumption that there is only one. For this reason, under the environment where two or more wireless tags, and a wireless tag reader / writer are intermingled in the same radio area, it interferes each other and good radio cannot be performed.

[0007] For example, to access from one a wireless tag reader / writer, two or more wireless tags may answer, or two or more wireless tag reader / writers may try access to the same wireless tag.

[0008] for example, in the ** table No. 513841 [2000 to] official report When answering appeal from one RF/ID reader, in order that two or more RF/ID tags may solve the problem of colliding mutually A tag with a different bitwise response from the response as which bitwise was determined beforehand is deactivated (deactivate). By activating alternatively a tag with the response as which bitwise was determined beforehand (activate), it is indicated about the approach and equipment for a RF discernment tag which are clearly obtained from two or more tags.

[0009] The problem that the response from a wireless tag will interfere mutually is avoidable by making the wireless tag which the reader/writer of a wireless tag does not make the partner of access be deactivated or sleep as proposed in this official report.

[0010] However, case [like a wireless tag with a reader/writer function which was mentioned above], even if the situation in which a wireless tag will be in sleeping and

a response interferes each other is avoidable, the problem that the demand from the reader/writer function will interfere with other reader/writers is still left behind.

[0011] Probably, the problem of interference of the communication link in such same radio area is applied also in a well-known IC card and IC card reader/writer as non-contact communication system. An IC card communicates by applying amplitude modulation to the signal which appears in the receiving circuit of reader/writer by changing the load between own antennas according to the reply signal over the question signal from reader/writer.

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EFFECT OF THE INVENTION

[Effect of the Invention] As a full account was given above, according to this invention, the outstanding radio communication equipment which performs a non-contact communication link using a wireless tag with the operating characteristic which sends the electric wave which answers having received the electric wave of a specific frequency and is equivalent to identification information or the information memorized and its control approach, a storage, and a list can be provided with a computer program.

[0100] Moreover, according to this invention, the outstanding radio communication equipment which equips the both sides of a wireless tag, and a wireless tag reader / writer ability, and operates suitably in radio area and its control approach, a storage, and a list can be provided with a computer program.

[0101] Moreover, according to this invention, the outstanding radio communication

equipment which can prevent interference of a wireless tag reader / writers in the environment where two or more wireless tags, and a wireless tag reader / writer are intermingled in the same radio area and its control approach, a storage, and a list can be provided with a computer program.

[0102] According to this invention, in the radio communications system which serves as a wireless tag from a wireless tag reader / writer, wireless tag R/W equipment itself can carry out behavior as a wireless tag to the demand from other wireless tag R/W equipments by adding a function equivalent to a wireless tag to a wireless tag reader / writer. Moreover, when a sleep demand is received from external wireless tag reader / writer, forbidding the passive signal transmission in a wireless tag can be interlocked with, and interference of a mutual demand signal with other wireless tag reader writers can be mitigated by forbidding the active signal transmission in a wireless tag reader / writer.

[0103] Furthermore, according to this invention, since the above-mentioned effectiveness is acquired without adding modification to especially the wireless specification between a wireless tag, and a wireless tag reader / writer, mounting cost can be reduced sharply.

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TECHNICAL PROBLEM

[Problem(s) to be Solved by the Invention] The purpose of this invention is to provide the outstanding radio communication equipment which performs a non-contact communication link using a wireless tag with the operating characteristic which sends

the electric wave which answers having received the electric wave of a specific frequency and is equivalent to identification information or the information memorized and its control approach, a storage, and a list with a computer program.

[0013] The further purpose of this invention is to provide with a computer program the outstanding radio communication equipment which equips the both sides of a wireless tag, and a wireless tag reader / writer ability, and operates suitably in radio area and its control approach, a storage, and a list.

[0014] The further purpose of this invention is to provide with a computer program the outstanding radio communication equipment which can prevent interference of a wireless tag reader / writers in the environment where two or more wireless tags, and a wireless tag reader / writer are intermingled in the same radio area and its control approach, a storage, and a list.

[0015]

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OPERATION

[Means for Solving the Problem and its Function] This invention is made in consideration of the above-mentioned technical problem. The 1st side face With the passive communications department which is the radio communication equipment which transmits and receives wireless data, and returns the reply signal over this while receiving the demand signal from the outside Having the active communications department which receives the reply signal over this, while transmitting a demand signal outside, said passive communications department is a radio communication

equipment characterized by the thing answer having received the sleep demand signal, lapse into sleeping, and it stops answering a demand signal for from the outside.

[0016] With moreover, the passive communications department which returns the reply signal over this while the 2nd side face of this invention receives the demand signal from the outside It has the active communications department which receives the reply signal over this while transmitting a demand signal outside. It is the control approach of the radio communication equipment which transmits and receives wireless data, and is the control approach of the radio communication equipment characterized by what it has for the step to which answer having received the sleep demand signal, and said passive communications department lapses into sleeping, and stops answering a demand signal from the outside.

[0017] According to the radio communication equipment concerning the 1st or 2nd side face of this invention, or its control approach, even if it is a case so that two or more radio communication equipments may be intermingled in the same radio area, the reply signal from two or more passive communications departments which receive the same demand signal can interfere, and a certain thing can be avoided.

[0018] Said passive communications department cancels sleeping according to having received the sleep discharge demand signal by sleeping, and the response to the demand signal from the outside is resumed.

[0019] Moreover, as for said active communications department, transmission of a demand signal is forbidden for said passive communications department between sleeping. Therefore, even if it is a case so that two or more radio communication equipments may be intermingled in the same radio area, the demand signal from the mutual active communications department can interfere, and a certain thing can be avoided.

[0020] Here, said active communications department can constitute as a wireless tag reader which modulates a demand signal and is sent out as an electric wave of predetermined transmit frequencies. Moreover, said passive communications department can constitute as a wireless tag which recognizes the demand signal received from the outside in the state of non-contact.

[0021] That is, the wireless tag reader itself can carry out behavior as a wireless tag to the demand from other wireless tag readers by adding a function equivalent to a wireless tag to a wireless tag reader. In such a case, when a sleep demand is received from an external wireless tag reader, the radio communication equipment concerning the 1st side face of this invention can be interlocked with forbidding the passive signal transmission in a wireless tag, and can mitigate interference of a demand signal among

other wireless tag readers by forbidding the active signal transmission in a wireless tag reader.

[0022] Or said active communications department can constitute as an IC card reader which receives a reply signal, applying a modulation to the signal which appears according to the load effect between the antennas in said passive communications department. Moreover, said passive communications department can constitute as an IC card to which the load between own antennas is changed according to the reply signal over the demand signal from the outside.

[0023] In such a case, when a sleep demand is received from an external IC card reader, the radio communication equipment concerning the 1st side face of this invention can be interlocked with forbidding the passive signal transmission in an IC card, and can mitigate interference of a demand signal among other IC card readers by forbidding the active signal transmission in an IC card reader.

[0024] With moreover, the passive communications department which returns the reply signal over this while the 3rd side face of this invention receives the demand signal from the outside It is the storage which stored physically the computer software described to perform control of the radio communication equipment equipped with the active communications department which receives the reply signal over this while transmitting a demand signal outside on computer system in the computer-readable format. The step which it answers that said computer software received the sleep demand signal, and said passive communications department lapses into sleeping, and is answered and made into a demand signal from the outside, The step which said passive communications department cancels sleeping and makes resume the sleep discharge. The step which said passive communications department cancels sleeping and makes resume the response to the demand signal from the outside according to having received the sleep discharge demand signal. Said passive communications department is the storage characterized by providing the step which forbids transmission of the demand signal by said active communications department between sleeping.

[0025] The storage concerning the 3rd side face of this invention is a medium which offers computer software in a computer-readable format to the general purpose computer system which can perform various program codes, for example, Attachment and detachment of DVD (Digital Versatile Disc), CD (Compact Disc), FD (FloppyDisk), MO (Magneto-Optical disc), etc., etc. are free for such a medium, and it is a storage of portability. Or it is also technically possible to provide specific computer system with computer software via transmission media, such as a network (for a network not to ask distinction of wireless and a cable), etc.

[0026] The storage concerning the 3rd side face of this invention defines the

collaboration-relation on the structure of the computer software and the storage for realizing the function of computer software predetermined in a computer system top, or a function. If it puts in another way, by installing predetermined computer software in computer system through the storage concerning the 3rd side face of this invention, on computer system, a collaboration-operation is demonstrated and the same operation effectiveness as the radio communication equipment concerning each 1st [of this invention] and 2nd side faces or its control approach can be acquired.

[0027] With moreover, the passive communications department which returns the reply signal over this while the 4th side face of this invention receives the demand signal from the outside It is the computer program described to perform control of the radio communication equipment equipped with the active communications department which receives the reply signal over this while transmitting a demand signal outside on computer system. The step which it answers having received the sleep demand signal, and said passive communications department lapses into sleeping, and is answered and made into a demand signal from the outside, The step which said passive communications department cancels sleeping and makes resume the response to the demand signal from the outside according to having received the sleep discharge demand signal. Said passive communications department is the computer program characterized by providing the step which forbids transmission of the demand signal by said active communications department between sleeping.

[0028] The computer program concerning the 4th side face of this invention defines the computer program described to realize processing predetermined in a computer system top in the computer-readable format. If it puts in another way, by installing the computer program concerning the 4th side face of this invention in computer system, on computer system, a collaboration-operation is demonstrated and the same operation effectiveness as the radio communication equipment concerning each 1st [of this invention] and 2nd side faces or its control approach can be acquired.

[0029] The purpose, the description, and advantage of further others of this invention will become [rather than] clear by detailed explanation based on the operation gestalt and the drawing to attach of this invention mentioned later.

[0030]

[Embodiment of the Invention] Hereafter, it explains in detail about the operation gestalt of this invention, referring to a drawing.

[0031] The situation of radio area which realized this invention is shown in drawing 1. In this radio area, two or more reader writer equipments are intermingled in two or more wireless tags and a list. In this drawing, reference numbers 1 and 2 are wireless

tags, and reference numbers 3 and 4 are a wireless tag reader / writer. Hereafter, when you only call it "a wireless tag reader / writer", suppose that it is the radio communication equipment equipped with a wireless tag and the both sides of a reader/writer function.

[0032] In the example shown in drawing 1, read-out or a write request is transmitted to the wireless tags 1 and 2 with which a wireless tag reader / writer 3 exists in the same radio area, and a list to a wireless tag reader / writer 4, and signs that the response is received are shown. In this case, if it sees from a wireless tag reader / writer 3, a wireless tag reader / writer 4 will act like the wireless tags 1 and 2. That is, a wireless tag reader / writer 3 also recognizes a wireless tag reader / writer 4 as one of the wireless tags.

[0033] Furthermore, in the example shown in this drawing, in order to mitigate the interference to a wireless tag reader / writer 3, the wireless tag reader / writer 4 has controlled sending out a sending signal active as reader/writer.

[0034] The hardware configuration of the radio communication equipment 100 equipped with the function of a wireless tag and the both sides of reader/writer is typically shown in drawing 2. Hereafter, each part is explained, referring to this drawing.

[0035] A reference number 101 is a non-volatile storage region, for example, consists of nonvolatile memory equipment in which writing like EEPROM (Electrically Erasable and Programmable ROM) is possible, and external storage like hard disk equipment. This non-volatile storage region 101 is equipped with the usable storage region general-purpose [the control-software storing field holding the program code for controlling actuation of a radio communication equipment 100, the virtual tag storage region used when a radio communication equipment 100 acts as a wireless tag (or other passive communication devices), and others].

[0036] A reference number 102 is a display with an output screen, for example, consists of liquid crystal display displays (LCD), and it is used in order to display actuation of a radio communication equipment 100 and a condition.

[0037] A reference number 103 is CPU (Central Processing Unit) which controls actuation of the radio-communication-equipment 100 whole in generalization.

Moreover, a reference number 104 is temporary storage 104, and consists of volatile memory equipment in which rewriting like RAM (Random Access Memory) is possible. CPU103 performs the program code loaded on temporary storage 104 from the control-software storing field of the non-volatile storage region 101, and saves the activity data under program execution in temporary storage 104 temporarily.

[0038] A reference number 105 is the input section for a user to input an actuation command, data, etc. The input section 105 consists of two or more keys, a carbon button, or a touch panel on which the display screen of a display 102 was overlapped.

[0039] A reference number 106 is the Radio Communications Department, is a functional module which performs the exterior and radio according to the command from CPU103, and is equipped with RF block which transmits and receives the baseband block which manages transmission and reception of a signal, and predetermined RF signalling frequency through an antenna 107. The Radio Communications Department 106 can consist of general-purpose logic devices like FPGA (Field Programmable Gate Array) into which a user can change internal logic by the program after IC completion.

[0040] With this operation gestalt, the Radio Communications Department 106 has the passive communication facility which receives the demand signal from the outside and returns a reply signal, and the active communication facility which receives the reply signal from the exterior while transmitting a demand signal outside. However, the after-mentioned is yielded about these details.

[0041] A reference number 108 is an external interface, and it can be used in order to connect a radio communication equipment 100 with a computer, other information machines and equipment, and an information processing terminal. An external interface is Ethernet, RS232C, and USB (Universal Serial Bus), IrDA, Bluetooth and IEEE. It can constitute from standard interfaces, such as 802.11b.

[0042] The functional configuration of the Radio Communications Department 106 is typically shown in drawing 3. As shown in this drawing, it has passive communications department 106A which receives the demand signal from the outside and returns a reply signal, and active communications department 106B which receives the reply signal from the exterior while transmitting a demand signal outside.

[0043] Passive communications department 106A can be read from the exterior, and can receive demand signals, such as a demand, and a sleep demand besides a write request, a sleep discharge demand. When a read-out demand is received, a letter is answered in the requested data stored in the virtual tag storage region of the non-volatile storage region 101. Moreover, when a write request is received, requested data is written in the virtual tag storage region of the non-volatile storage region 101.

[0044] Moreover, passive communications department 106A answers having received the sleep demand, and lapses into sleeping. It stops answering a read-out demand and a write request from the outside in sleeping. For example, when two or more passive

communications department 106A in the same radio area is intermingled, the problem that the response from passive communications department 106A will interfere mutually can be avoided by setting it except specific passive communications department 106A as sleeping. Sleeping is continued until it receives a sleep discharge demand and sleep is canceled.

[0045] Passive communications department 106A holds any of an own condition, i.e., sleeping, or a sleep discharge condition they are to condition attaching part 106C.

Active communications department 10B can access condition attaching part 106C of passive communications department 106A.

[0046] One active communications department 106B can receive the reply signal over this while it is read outside and transmits demand signals, such as a demand, and a sleep demand besides a write request, a sleep discharge demand. By transmitting a sleep demand, the sleeping can be canceled by making the other party's passive communications department 106A change to sleeping, and transmitting a sleep discharge demand.

[0047] Active communications department 10B distinguishes whether passive communications department 106A is sleeping with reference to condition attaching part 106C in passive communications department 106A, before transmitting a demand signal. And if it is sleeping, sending out of a demand signal will be disabled, this — for example, when two or more active communications department 10B is intermingled in the same radio area, the problem that a demand signal will interfere mutually can be avoided.

[0048] A wireless tag with the operating characteristic which sends the electric wave which answers having received the electric wave of a specific frequency as an example of the combination of passive communication facility and active communication facility, and is equivalent to identification information or the information memorized, and a wireless-tag reader / writer can be mentioned.

[0049] Here, the structure to which the wireless tag reader / writer as the active communications department carry out R/W actuation to the wireless tag as the passive communications department is explained, referring to drawing 4. a wireless transmission and reception in the example of illustration sake — electromagnetism — the transfer method is adopted.

[0050] In this drawing, a reference number 11 is a wireless tag and consists of a tag chip 12 and an antenna 13.

[0051] The dipole antenna of the half-wave length etc. is used for an antenna 13.

Moreover, the tag chip 12 consists of the modulation section 20, the rectification /

recovery section 22, and the memory section 23. The memory section 23 is equivalent to a virtual tag storage region (above-mentioned).

[0052] It is received by the antenna 13 and the electric wave is transmitted from the wireless tag reader / writer 10 is inputted into rectification / recovery section 22.

Here, a recovery function carries out initiation of operation according to this power source, and it is recognized that it is a reading signal over the wireless tag 11 at the same time an electric wave is rectified and it is changed into DC power supply. The generated power source is supplied also to the memory section 23 and the modulation section 20.

[0053] The memory section 23 reads information, such as ID beforehand stored in the interior, and sends it to the modulation section 20 as transmit data. The modulation section 20 consists of diode switches 21, and a diode switch 21 repeats ON / off actuation with transmit data. That is, when data are 1, it becomes ON and termination of the antenna 13 is carried out with an antenna impedance (for example, 50 ohms).

[0054] At this time, the electric wave from a wireless tag reader / writer 10 is absorbed by the wireless tag 11 side. When data are 0, it becomes off, and a diode switch 21 will be in an opening condition, and the termination of an antenna 13 will also be in an opening condition at coincidence. At this time, it will be reflected and the electric wave from a tag reader / writer 10 will return to a transmitting agency.

[0055] Such a correspondence procedure is called a "back-scatter method." In this way, the wireless tag 11 becomes possible [sending the information on internal to wireless tag reader / writer 10 side with a non-power source].

[0056] One wireless tag reader / writer 10 consist of antennas 15 connected to the tag reading module 14 and this tag reading module 14, and is used, connecting with the host device 16. The host device 16 consists of information terminals, such as CPU103 in a radio communication equipment 100, a personal computer further connected by external-interface 108 course, and PDA (Personal Digital Assistant), and offers a user interface for a user to perform a dialogue input.

[0057] The host device 16 notifies reading directions of the wireless tag 11 to the communications control section 30 via the host interface section 31 first.

[0058] The baseband processing section 29 sends baseband signaling to the ASK (Amplitude Shift Keying) modulation section 27, after filtering by editing into transmit data, if the reading command of the tag from the communications control section 30 is received. The ASK modulation section 27 performs an ASK modulation on the frequency of a frequency synthesizer 26.

[0059] The frequency setting of a frequency synthesizer 26 is performed by the

communications control section 30. Generally, for mitigation of the standing wave of the signal from the wireless tag 11, or a multi-pass, the hopping of the transmit frequencies to the wireless tag 11 is carried out, and they are used. Directions of this hopping are also performed by the communications control section 30. The sending signal to which the ASK modulation was applied is emitted towards the wireless tag 11 via a circulator 24 from an antenna 15.

[0060] As stated previously, the reflective signal from the wireless tag 11 which has returned by the back-scatter method is the same frequency as the signal transmitted from the wireless tag reader / writer 10. It is received by the antenna 15 of a wireless tag reader / writer 10, and this signal is inputted into a mixer 25.

[0061] Since the same local frequency f_0 as the time of transmission is inputted into a mixer 25, in the output of a mixer 25, the signal to which the modulation was applied by the wireless tag 11 side will appear.

[0062] In the recovery section 28, it recovers from this signal to the data of 1/0, and sends to the baseband processing section 29. In the baseband processing section 29, data are decoded and the data stored in the memory section 23 in the wireless tag 11 are taken out. This data is transmitted to the host device 16 from the host interface section 31 according to directions of the communications control section 30.

[0063] A wireless tag reader / writer 10 can read the information in the wireless tag 11 as mentioned above. Moreover, a wireless tag reader / writer 10 can perform write-in actuation to the wireless tag 11 in the same actuation as ****. In this case, the data by the side of the host device 16 can be written in the memory section 23 (namely, virtual tag storage region) in the wireless tag 11.

[0064] Moreover, IC card reader/writer can be mentioned to the noncontact IC card list which communicates by applying amplitude modulation to the signal which appears in the receiving circuit of reader/writer by changing the load between own antennas according to the reply signal over the demand signal from reader/writer as other examples about the combination of passive communication facility and active communication facility.

[0065] Radio between an IC card and IC card reader/writer is realized based on the principle of electromagnetic induction. In drawing 5, the structure of the radio of an IC card and IC card reader/writer based on electromagnetic induction is illustrated notionally. IC card reader/writer is equipped with the antenna LRW which consisted of loop-formation coils, and a field is generated by passing Current IRW at this antenna LRW around it. On the other hand, the loop-formation coil Lc is electrically made with the IC card side around the IC card. In the loop-formation coil Lc edge by the side of

an IC card, the induced voltage by the field which the loop antenna Lc by the side of IC card reader/writer emits arises, and it is inputted into the terminal of the IC card connected to the loop-formation coil Lc edge.

[0066] Although the degree of coupling changes according to mutual physical relationship, the loop-formation coil Lc by the side of the antenna LRW by the side of IC card reader/writer and an IC card can be caught if one transformer is formed as a system, and as shown in drawing 6, it can model R/W actuation of an IC card.

[0067] At an IC card reader/writer side, in modulating the current IRW passed at Antenna LRW, the electrical potential difference VO by which induction is carried out to the loop-formation coil Lc on IC chip can receive a modulation, and IC card reader/writer can perform data transmission to an IC card using that

[0068] Moreover, an IC card has the function (Load Switching) to fluctuate the load between the terminals of the loop-formation coil Lc according to the data for returning IC card reader/writer. If the load between the terminals of the loop-formation coil Lc is changed, in an IC card reader/writer side, the impedance between antenna terminals changes, and it will become fluctuation of the passage current IRW of Antenna LRW, or an electrical potential difference VRW, and will appear. By restoring to a part for this fluctuation, IC card reader/writer can receive the return data of an IC card.

[0069] Namely, an IC card can communicate by applying amplitude modulation to the signal which appears in the receiving circuit by the side of card R/W equipment by changing the load between own antennas according to the reply signal over the demand signal from IC card reader/writer.

[0070] In the form of the flow chart shows the signal reception actuation in a radio communication equipment 100 to drawing 7. A radio communication equipment makes possible behavior as passive communication facility like the usual wireless tag (or IC card), and this actuation is realized with the gestalt of performing the control software with which CPU103 is stored in the non-volatile storage region 101. Or it is also possible to realize by the logic mounted in the baseband block in the Radio Communications Department 106 constituted by FPGA etc. Hereafter, the signal reception in a radio communication equipment 100 is explained, referring to this flow chart.

[0071] If signal reception starts in a radio communication equipment 100, in step S1, sleeping will be initialized off first. And it will be in the condition of the waiting for signal reception at step S2 after this.

[0072] In a signal receiving waiting state, if a radio communication equipment 100

receives a reply signal from passive communication facility, such as an external wireless tag (or IC card), or receives a demand signal from active reception functions, such as a wireless tag reader / writer (or IC card reader/writer), it will progress to step S3 and sleeping will be judged.

[0073] In the decision block S3, when judged with sleeping being ON, it progresses to step S4 and judges whether the signal received further is a sleep discharge demand. In the case of signals other than a sleep discharge demand, the radio communication equipment 100 during sleep waits for return and the next signal reception to step S2, without processing anything.

[0074] On the other hand, when judged with it being a sleep discharge demand in step S4, after progressing to degree step S5 and setting up sleeping off, it waits for return and the next signal reception to step S2.

[0075] If processing in step S5 is performed, sleeping is canceled, and this radio communication equipment 100 will be in the condition that various demands as a wireless tag reader / a writer (or IC card reader/writer) can be transmitted while being in the condition that it can answer to various demands as passive communication facility, such as a wireless tag (or IC card).

[0076] Moreover, in the decision block S3, when judged with sleeping being off, the signal progressed and received to step S6 judges whether it is a demand signal from active communication facility, such as other wireless tag reader / writers (or IC card reader/writer), or it is a reply signal from passive communication facility, such as other wireless tags (or IC card).

[0077] In the decision block S6, when judged with it being a demand signal from active communication facility, such as other wireless tag reader / writers (or IC card reader/writer), it progresses to step S7 and judges whether an input signal is a sleep demand further.

[0078] When judged with it being a sleep demand in the decision block S7, after setting sleeping as ON in a degree S8, it waits for return and the next signal reception to step S2.

[0079] If step S8 is processed, this radio communication equipment 100 will not transmit various demands as active communication facility, such as a wireless tag reader / writer (or IC card reader/writer), while stopping answering to various demands as passive communication facility, such as a wireless tag (or IC card), until sleeping is canceled.

[0080] Moreover, in the decision block S7, when judged with an input signal being except a sleep demand, it progresses to step S10 and the Radio Communications

Department 106 performs, the behavior, i.e., the demand reception, as passive communication facility, such as a wireless tag (or IC card). Then, it waits for return and the next signal reception to step S2. Drawing 9 explains the demand reception in step S10 separately on the relation of space.

[0081] When it judges that an input signal is not a demand signal from active communication facility, such as other wireless tag reader / writers (or IC card reader/writer), in the decision block S6, namely, when judged with it being a reply signal from passive communication facility, such as other wireless tags (or IC card) it progresses to step S9 and performs, the behavior, i.e., the response reception, as active communication facility, such as a wireless tag reader / writer (or IC card reader/writer). Then, it waits for return and the next signal reception to step S2. Drawing 8 explains the response reception in step S9 separately on the relation of space.

[0082] In the form of the flow chart shows the procedure of the response reception in step 9 in the flow chart shown in drawing 7 to drawing 8. As for this response reception, a radio communication equipment 100 is equivalent to the behavior as active communication facility, such as a wireless tag reader / writer (or IC card reader/writer). This response reception is realized with the gestalt of performing the control software with which CPU103 is stored in the non-volatilized storage region 101. Or it is also possible to realize by the logic mounted in the baseband block in the Radio Communications Department 106 constituted by FPGA etc. Hereafter, the response reception of a radio communication equipment 100 is explained, referring to this flow chart.

[0083] A radio communication equipment 100 creates a response result after reply signal reception initiation, returns processing to the procedure of call origin (step S21), and ends response reception.

[0084] Moreover, in the form of the flow chart shows the procedure of the demand reception in step 10 in the flow chart shown in drawing 7 to drawing 9. As for this demand reception, a radio communication equipment 100 is equivalent to the behavior as passive communication facility, such as a wireless tag (or IC card). This demand reception is realized with the gestalt of performing the control software with which CPU103 is stored in the non-volatilized storage region 101. Or it is also possible to realize by the logic mounted in the baseband block in the Radio Communications Department 106 constituted by FPGA etc. Hereafter, the demand reception of a radio communication equipment 100 is explained, referring to this flow chart.

[0085] First, in step S31, it distinguishes whether the demand which received is ID

discernment demand. In being ID discernment demand, it progresses to step S32 and performs ID discernment processing. ID discernment processing is reading ID which passive communication facility's, such as this wireless tag's, has. With this operation gestalt, ID is read from the inside of the virtual tag storage region of the non-volatilized storage region 101, and it is sent out to a requiring agency.

[0086] Moreover, if the demand which received is not ID discernment demand, subsequently in step S34, it will distinguish whether it is a write request. In being a write request, it progresses to step S35 and performs write-in processing. It is writing the demanded information in the demanded location to the virtual tag storage region in the non-volatilized storage region 101 indicated to be write-in processing in this operation gestalt to drawing 2.

[0087] Moreover, if the demand which received is not a write request, subsequently in step S36, it will distinguish whether it is a read-out demand. In being a read-out demand, it progresses to step S37 and performs read-out processing. It is reading in the demanded size from the location of which the information currently held in the virtual tag storage region in the non-volatilized storage region 101 indicated to be read-out processing in this operation gestalt to drawing 2 was required.

[0088] After processing the demand which these-received, a reply signal is transmitted to a requiring agency at step S33, and this whole manipulation routine is ended.

[0089] Moreover, in the form of the flow chart shows procedure for a radio communication equipment 100 to perform signal transmitting processing to drawing 10. According to this procedure, in case it acts as active communication facility, such as a wireless tag reader / writer (or IC card reader/writer), transmitting processing of an active demand signal is restricted according to the condition (that is, is it sleeping or not?) of passive communication facility, such as a wireless tag (or IC card).

[0090] This procedure is realized with the gestalt of performing the control software with which CPU103 is stored in the non-volatilized storage region 101. Or it is also possible to realize by the logic mounted in the baseband block in the Radio Communications Department 106 constituted by FPGA etc. Hereafter, the signal transmitting processing in a radio communication equipment 100 is explained, referring to this flow chart.

[0091] In case a radio communication equipment 100 transmits various demand signals by actuation of the control software stored in the non-volatilized storage region 101, it distinguishes first whether passive communication facility section 106A, such as a wireless tag (or IC card), is sleeping in step S41.

[0092] Since there is no fear of a demand signal interfering mutually among other radio communication equipments when judged with it not being sleeping, it progresses to step S42 and demand signal transmission is performed as it is.

[0093] On the other hand, in the decision block S41, when judged with passive communication facility section 106A, such as a wireless tag (or IC card), being sleeping, in order to restrict signal transmission and to avoid interference with other demand signals, it progresses to step S43, under sleep is set as a response result, and this manipulation routine is ended.

[0094] The demand signal used for the following table 1 between the radio communication equipments which consist of a wireless tag and wireless tag reader writer equipment is packed. The radio communication equipment 100 in the operation gestalt of this invention mentioned above needs to have at worst the function in which these demand signals can be transmitted. About the demand signal except having been shown here, addition and modification of may be done if needed.

[0095]

[Table 1]

信号名	内容
I D 識別要求	周囲の無線タグ、無線タグリーダー・ライター装置が持つ I D を取得するための要求信号。
スリープ要求	周囲の無線タグ、無線タグリーダー・ライター装置に対し、スリープ状態にさせるための要求信号。
スリープ解除要求	周囲の無線タグ、無線タグリーダー・ライター装置に対し、スリープ状態を解除させるための要求信号。
書き込み要求	周囲の無線タグ、無線タグリーダー・ライター装置に対し、情報を書き込むための要求信号。
読み出し要求	周囲の無線タグ、無線タグリーダー・ライター装置から情報を読み出すための要求信号。

[0096] Moreover, the reply signal used for the following table 2 between the radio communication equipments which consist of a wireless tag and wireless tag reader writer equipment is packed. The radio communication equipment 100 in the operation form of this invention mentioned above needs to have at worst the function in which these reply signals can be transmitted. About the reply signal except having been shown here, addition and modification of may be done if needed.

[0097]

[Table 2]

原号名	内容
1D識別応答	無線タグ、無線タグリーダー・ライタ装置が持つIDを要求元に返すための応答信号。
書き込み応答	無線タグ、無線タグリーダー・ライタ装置が持つ記憶領域に情報を書き込んだ結果を返すための応答信号。
読み出し応答	無線タグ、無線タグリーダー・ライタ装置が持つ記憶領域から情報を読み出した結果を返すための応答信号。

[0098] It has explained in detail about this invention, referring to a specific operation gestalt more than [addenda]. However, it is obvious that this contractor can accomplish correction and substitution of this operation gestalt in the range which does not deviate from the summary of this invention. That is, this invention should not be indicated with the gestalt of instantiation, and the written contents of this specification should not be interpreted restrictively. In order to judge the summary of this invention, the column of the claim indicated at the beginning should be taken into consideration.

[Translation done.]

* NOTICES *

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1. This document has been translated by computer. So the translation may not reflect the original precisely.
- 2.*** shows the word which can not be translated.
- 3.In the drawings, any words are not translated.

DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]

- [Drawing 1] It is drawing having shown the situation of radio area which realized this invention.
- [Drawing 2] It is drawing having shown typically the hardware configuration of the radio communication equipment 100 equipped with the function of a wireless tag and

the both sides of reader/writer.

[Drawing 3] It is the block diagram having shown the functional configuration of the Radio Communications Department 106 typically.

[Drawing 4] It is drawing for explaining the structure to which the wireless tag reader / writer as the active communications department perform R/W actuation to the wireless tag as the passive communications department.

[Drawing 5] It is drawing having shown notionally the structure of the radio of an IC card and IC card reader/writer based on electromagnetic induction.

[Drawing 6] It is drawing which modeled R/W actuation of an IC card.

[Drawing 7] It is drawing having shown the signal reception actuation in a radio communication equipment 100 in the form of the flow chart.

[Drawing 8] It is the flow chart which showed the procedure of the response reception in step 9 in the flow chart shown in drawing 7 .

[Drawing 9] It is the flow chart which showed the procedure of the demand reception in step S10 in the flow chart shown in drawing 7 .

[Drawing 10] It is the flow chart which showed procedure for a radio communication equipment 100 to perform signal transmitting processing.

[Description of Notations]

- 100 -- Radio communication equipment
- 101 -- Non-volatile storage region
- 102 -- Display
- 103 -- CPU
- 104 -- Temporary storage
- 105 -- Input section
- 106 -- Radio Communications Department
- 107 -- Antenna
- 108 -- External interface

[Translation done.]

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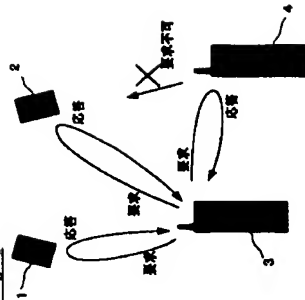
1. This document has been translated by computer. So the translation may not reflect the original precisely.

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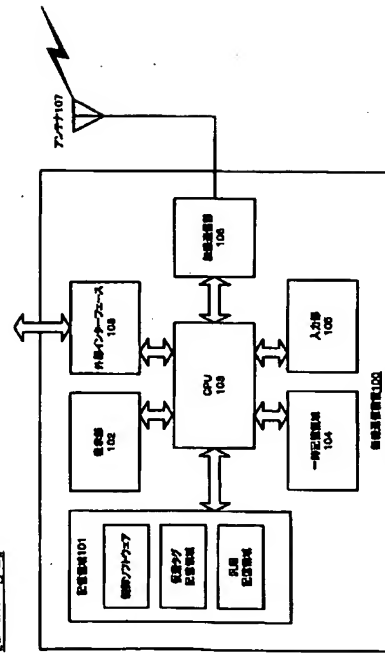
3. In the drawings, any words are not translated.

DRAWINGS

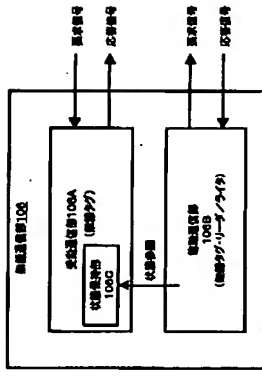
[Drawing 1]



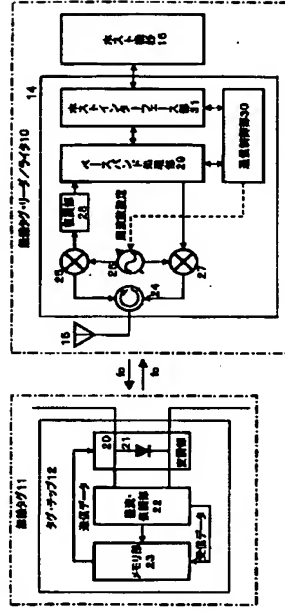
[Drawing 2]



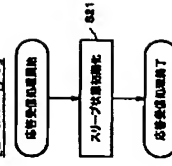
[Drawing 3]



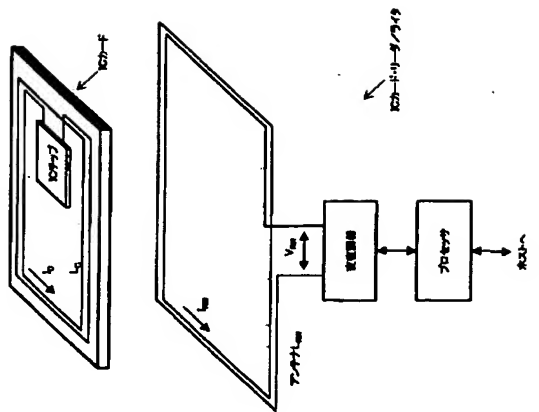
[Drawing 4]



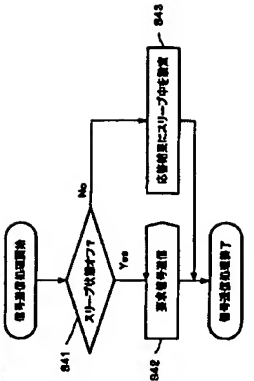
[Drawing 8]



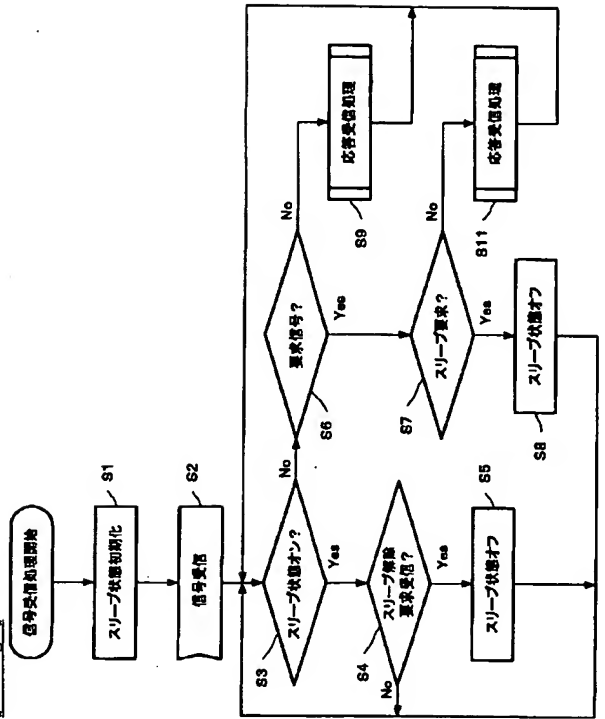
[Drawing 5]



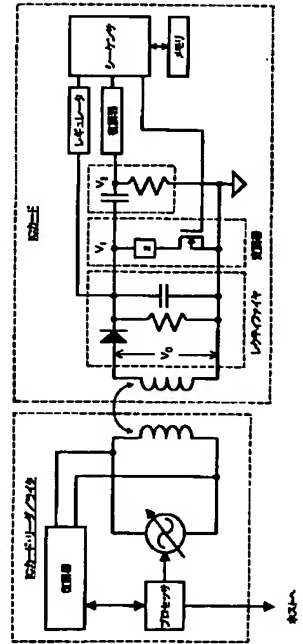
[Drawing 10]



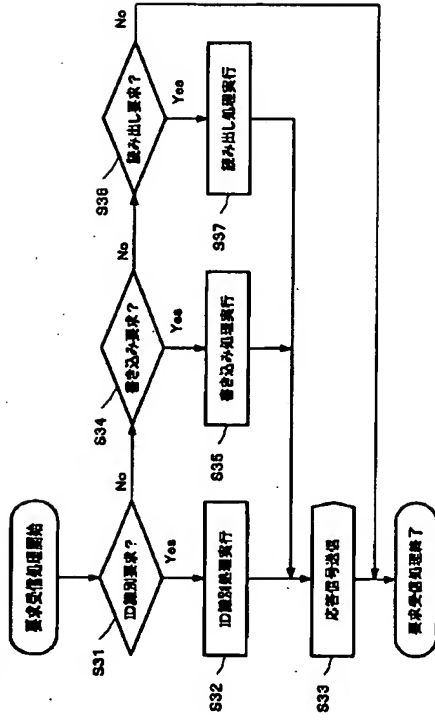
[Drawing 7]



[Drawing 6]



[Drawing 9]



[Translation done.]

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	19/07	H 0 4 B 5/02	5 B 0 5 8
H 0 4 B 5/02		G 0 6 K 19/00	H 5 K 0 1 2
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(54)【発明の名称】 無線通信装置及びその制御方法、記憶媒体、並びにコンピュータ・プログラム

(57)【要約】

【課題】 無線タグ・リーダー/ライタ同士の干渉を防止する。

【解決手段】 無線タグ・リーダー/ライタに無線タグとライタ自身が他の無線タグ・リーダー/ライタからの要求に対して無線タグとしての振る舞いをする事ができる。また、外部の無線タグ・リーダー/ライタからスリープ要求を受信したときに、無線タグにおける受動的な信号送信を禁止することに運動して、無線タグ・リーダー/ライタにおける能動的な信号送信も禁止することにより、他の無線タグ・リーダー/ライタとの間で要求信号の干渉を軽減することができる。

1 送信 2 受信 3 送信 4 受信

禁止

【特許請求の範囲】

【請求項1】無線データを送受信する無線通信装置であって、

外部からの要求信号を受信するとともにこれに対する応答信号を送信する受動通信部と、

外部に要求信号を送信するとともにこれに対する応答信号を受信する能動通信部とを備え、

前記受動通信部はスリープ要求信号を受信したことに応じてスリープ状態に陥って外部からの要求信号に反応しなくなる、ことを特徴とする無線通信装置。

【請求項2】前記受動通信部はスリープ解除要求信号を受信したことに応じてスリープ状態を解除して外部からの要求信号に対する応答を再開する、ことを特徴とする無線通信装置。

【請求項3】前記受動通信部がスリープ状態の間、前記能動通信部は要求信号の送信が禁止される、ことを特徴とする請求項1に記載の無線通信装置。

【請求項4】前記能動通信部は、要求信号を受信して所定の送信周波数の電波として送出する無線タグ・リーダーであり、

前記受動通信部は、外部から受信した要求信号を非接触状態で認識する無線タグである、ことを特徴とする請求項1に記載の無線通信装置。

【請求項5】前記能動通信部は、前記受動通信部におけるアンテナ間の負荷変動に応じて現れる信号に変調をかけて応答信号を受信するICカード・リーダーであり、前記受動通信部は、外部からの要求信号に対する応答信号に応じて自身のアンテナ間の負荷を変化させるICカードである、ことを特徴とする請求項1に記載の無線通信装置。

【請求項6】外部からの要求信号を受信するとともにこれに対する応答信号を送信する受動通信部と、外部に要求信号を送信するとともにこれに対する応答信号を受信する能動通信部とを備えた無線通信装置の制御をコンピュータ・システム上で実行するように記述されたコンピュータ・ソフトウェアをコンピュータ可読形式で物理的に格納した記憶媒体であって、前記コンピュータ・ソフトウェアは、

スリープ要求信号を受信したことに応じて前記受動通信部がスリープ状態に陥って外部からの要求信号に反応しなくなるステップと、

スリープ解除要求信号を受信したことに応じて前記受動通信部がスリープ状態を解除して外部からの要求信号に対する応答を再開させるステップと、

前記受動通信部がスリープ状態の間、前記能動通信部による要求信号の送信を禁止するステップと、を具備することを特徴とする記憶媒体。

【請求項7】スリープ解除要求信号を受信したことに応じて前記受動通信部がスリープ状態を解除して外部からの要求信号に反応しなくなるステップと、

通信部がスリープ状態を解除して外部からの要求信号に対する応答を再開させるステップと、

前記受動通信部がスリープ状態の間、前記能動通信部による要求信号の送信を禁止するステップと、を具備することを特徴とするコンピュータ・プログラム。

【請求項8】前記受動通信部がスリープ状態の間、前記能動通信部による要求信号の送信を禁止するステップをさらに備える、ことを特徴とする請求項6に記載の無線通信装置の制御方法。

【請求項9】前記能動通信部は、要求信号を受信して所

【発明の詳細な説明】

【0001】

【発明の属する技術分野】 本発明は、比較的距離の無線通信エリアで動作する無線通信装置及びその制御方法、記憶媒体、並びにコンピュータ・プログラムに係り、例えば特定周波数の電波を受信したことに応じて

例えば、無線通信装置100内のCPU103や、さらに外部インターフェース108經由で接続されるパーソナル・コンピュータやPDA (Personal Digital Assistant) などの情報端末で構成され、ユーザが対話人力を行ったためのユーザ・インターフェースを提供する。

【0057】ホスト機器106は、まず、無線タグ110の読み取り指示をホスト・インタフェース部31を經由して通信制御部30に通知する。

【0058】ベースバンド処理部29は、通信制御部30からのタグの読み取りコマンドを受け取ると、送信データに編成を行い、フィルタリングを行った後、ASK (Amplitude Shift Keying) 変調部27にベースバンド信号を送る。ASK変調部27は、周波数センサ26の周波数10でASK変調を行う。

【0059】周波数センサ26は、周波数設定、通信制御部30によって行われて、無線タグ11からの信号の定在波やマルチパスの軽減のために、無線タグ11への送信周波数は、ホッピングして用いられる。このホッピングの指示も通信制御部30によって行われる。ASK変調がかけられた送信信号は、サーキュレータ24を經由して、アンテナ15より無線タグ11に向けて放射される。

【0060】先に述べたように、バック・スキャッタ方式で受けて来た無線タグ11からの反射信号は、無線タグ・リーダー/ライタ10から送信された信号と同一周波数である。この信号は、無線タグ・リーダー/ライタ10のアンテナ15で受信され、ミキサー25に入力される。

【0061】ミキサー25には、送信時と同じローカル周波数10が入力されるため、ミキサー25の出力には、無線タグ11側で変調をかけた信号が現れることになる。

【0062】復調部28では、この信号から1/0のデータに復調を行い、ベースバンド処理部29に送る。ベースバンド処理部29では、データをデコードし、無線タグ11内のメモリ部23に格納されていたデータを取り出す。このデータは、通信制御部30の指示に従い、ホスト・インタフェース部31からホスト機器106に転送される。

【0063】以上のようにして、無線タグ・リーダー/ライタ10は、無線タグ11内の情報を読み出すことができる。また、無線タグ・リーダー/ライタ10は、上述と同様の動作で無線タグ11への書き込み動作を行なうことができる。この場合、ホスト機器106側の指定データを無線タグ11内のメモリ部23 (すなわち記憶領域) に書き込むことができる。

【0064】また、受動通信機能と能動通信機能の組合せについての他の例として、リーダー/ライタからの要求信号に対する応答信号に応じて自身のアンテナ間の負荷を変化させることによってリーダー/ライタの受信回路に

現れる信号に振幅変調をかけて通信を行う非接触ICカード並びにICカード・リーダー/ライタを挙げることができる。

【0065】ICカードとICカード・リーダー/ライタ間の無線通信は、例えば電磁誘導の原理に基づいて実現される。図5には、電磁誘導に基づくICカードとICカード・リーダー/ライタの無線通信の仕組みを概念的に図解している。ICカード・リーダー/ライタは、ループ・コイルで構成されたアンテナL₁を備え、このアンテナL₁に電流I₁を流すことでその周辺に磁界を発生させる。一方、ICカード側では、電気的にはICカードの周辺にループ・コイルL₂が形成されている。ICカード側のループ・コイルL₂の一端にはICカード・リーダー/ライタ側のループ・アンテナL₁が誘起する磁界による誘導電圧が生じて、ループ・コイルL₂の端に接続されたICカードの端子に入力される。

【0066】ICカード・リーダー/ライタ側のアンテナL₁とICカード側のループ・コイルL₂は、その結合度Hは相互の位置関係によって変わるが、系としては、個のトランスを形成していると捉えることができ、ICカードの読み書き動作を図6に示すようにモデル化することができる。

【0067】ICカード・リーダー/ライタ側では、アンテナL₁に流す電流I₁を変調することで、ICチップ上のループ・コイルL₂に誘起される電圧V₂は変調を受け、そのことを利用してICカード・リーダー/ライタはICカードへのデータ送信を行うことができる。

【0068】また、ICカードは、ICカード・リーダー/ライタへ返送するためのデータに応じてループ・コイルL₂の端子間の負荷を変動させる機能 (Load Switching) を持つ。ループ・コイルL₂の端子間の負荷が変動すると、ICカード・リーダー/ライタ側ではアンテナ端子間のインピーダンスが変化して、アンテナL₁の通過電流I₁や電圧V₁の変動となって現れる。この変動分を復調することで、ICカード・リーダー/ライタはICカードの送受信データを受信することができる。

【0069】すなわち、ICカードは、ICカード・リーダー/ライタからの要求信号に対する応答信号に応じて自身のアンテナ間の負荷を変化させることによって、カード読み書き装置側の受信回路に現れる信号に振幅変調をかけて通信を行うことができる。

【0070】図7には、無線通信装置100における信号受信処理動作をフローチャートの形式で示している。

この動作は、無線通信装置が通常の無線タグ (あるいはICカード) のような受動通信機能としての振る舞いを実現するためのものであり、例えば、CPU103が不揮発記憶領域101に格納されている制御ソフトウェアを実行するという形態で実現される。あるいは、FPGAなどによって構成された無線通信装置106内のベースバンド・ブロックに実装されたロジックによって実現すること

とも可能である。以下、このフローチャートを参照しながら、無線通信装置100における信号受信処理について説明する。

【0071】無線通信装置100において信号受信処理が起動すると、まずステップS1において、スリープ状態をオフに初期化する。そして、これ以降、ステップS2で信号受信待ちの状態となる。

【0072】信号受信待ち状態において、無線通信装置100が、外部の無線タグ (あるいはICカード) などの受動通信機能から応答信号を受け取り、あるいは無線タグ・リーダー/ライタ (あるいはICカード・リーダー/ライタ) などの能動通信機能から要求信号を受け取ると、ステップS3に進んでスリープ状態の判定を行う。

【0073】判断ブロックS3において、スリープ状態がオンであると判定された場合、ステップS4に進んで、さらに受信した信号がスリープ解除要求であるかどうかの判定を行う。スリープ解除要求以外の信号の場合、スリープ中にある無線通信装置100は、何も処理をせずにステップS2に戻り、次の信号受信を待つ。

【0074】他方、ステップS4においてスリープ解除要求であると判定された場合には、次ステップS5に進んで、スリープ状態をオフに設定した後、ステップS2に戻り、次の信号受信を待つ。

【0075】ステップS5における処理を行うと、この無線通信装置100は、スリープ状態が解除され、無線タグ (あるいはICカード) などの受動通信機能としてさまざまな要求に対して応答できる状態となるとともに、無線タグ・リーダー/ライタ (あるいはICカード・リーダー/ライタ) としてさまざまな要求を送信できる状態になる。

【0076】また、判断ブロックS3において、スリープ状態がオフである判定された場合には、ステップS6に進んで受信した信号が、他の無線タグ・リーダー/ライタ (あるいはICカード・リーダー/ライタ) などの能動通信機能からの要求信号であるか、又は、他の無線タグ (又はICカード) などの受動通信機能からの応答信号であるかを判定する。

【0077】判断ブロックS6において、他の無線タグ・リーダー/ライタ (あるいはICカード・リーダー/ライタ) などの能動通信機能からの要求信号であると判定された場合には、ステップS7に進んで、さらに受信信号がスリープ要求であるかを判定する。

【0078】判断ブロックS7においてスリープ要求であると判定された場合には、次S8においてスリープ状態をオンに設定した後、ステップS2に戻り、次の信号受信を待つ。

【0079】ステップS8の処理を行うと、この無線通信装置100は、スリープ状態が解除されるまで、無線タグ (あるいはICカード) などの受動通信機能として

さまざまな要求に対して応答しなくなるとともに、無線タグ・リーダー/ライタ (あるいはICカード・リーダー/ライタ) などの能動通信機能としてさまざまな要求を送信しなくなる。

【0080】また、判断ブロックS7において、受信信号がスリープ要求以外であると判定された場合には、ステップS10に進んで、無線通信装置106は無線タグ (あるいはICカード) などの受動通信機能としての振る舞い、すなわち要求受信処理を行う。その後、ステップS2に戻り、次の信号受信を待つ。ステップS10における要求受信処理については、紙面の関係上、別途、図9にて説明する。

【0081】判断ブロックS6において、受信信号が、他の無線タグ・リーダー/ライタ (あるいはICカード・リーダー/ライタ) などの能動通信機能からの要求信号であると判定された場合、すなわち、他の無線タグ (あるいはICカード) などの受動通信機能からの応答信号であると判定された場合には、ステップS9に進んで、無線タグ・リーダー/ライタ (あるいはICカード・リーダー/ライタ) などの能動通信機能としての振る舞い、すなわち要求受信処理を行う。その後、ステップS2に戻る。図8にて説明する。

【0082】図8には、図7に示したフローチャート中のステップ9における応答受信処理の手順をフローチャートの形式で示している。この応答受信処理は、無線通信装置100が無線タグ・リーダー/ライタ (あるいはICカード・リーダー/ライタ) などの能動通信機能として振る舞いに相当する。この応答受信処理は、例えば、CPU103が不揮発記憶領域101に格納されている制御ソフトウェアを実行するという形態で実現される。あるいは、FPGAなどによって構成された無線通信装置106内のベースバンド・ブロックに実装されたロジックによって実現することも可能である。以下、このフローチャートを参照しながら、無線通信装置100の応答受信処理について説明する。

【0083】無線通信装置100は、応答信号受信処理開始後、応答結果を作成し、呼び元の手段に処理を返して (ステップS21)、応答受信処理を終了する。

【0084】また、図9には、図7に示したフローチャート中のステップ10における要求受信処理の手順をフローチャートの形式で示している。この要求受信処理は、無線通信装置100が無線タグ (あるいはICカード) などの受動通信機能としての振る舞いに相当する。この要求受信処理は、例えば、CPU103が不揮発記憶領域101に格納されている制御ソフトウェアを実行するという形態で実現される。あるいは、FPGAなどによって構成された無線通信装置106内のベースバンド・ブロックに実装されたロジックによって実現すること

も可能である。以下、このフローチャートを参照しながら、無線通信装置100の要求受信処理について説明する。

【0085】まず、ステップS31において、受信した要求が1D識別要求であるかを判断する。1D識別要求である場合には、ステップS32に進んで、1D識別処理を実行する。1D識別処理とは、この無線タグなどの受動通信機能を持つ1Dを読み出すことである。この実施形態では、不揮発記憶領域101の仮想タグ記憶領域内から1Dが読み出されて、要求元へ送出される。

【0086】また、受信した要求が1D識別要求でなければ、次いでステップS34において、書き込み要求であるかを判断する。書き込み要求である場合には、ステップS35に進んで、書き込み処理を実行する。この実施形態では、不揮発記憶領域101内の仮想タグ記憶領域に対して、要求された位置に、要求された情報を書き込むことである。

【0087】また、受信した要求が書き込み要求でなければ、次いでステップS36において、読み出し要求であるかを判断する。読み出し要求である場合には、ステップS37に進んで、読み出し処理を実行する。この実施形態における読み出し処理とは、図2に示した不揮発記憶領域101内の仮想タグ記憶領域に保持されている情報を、要求された位置から、要求されたサイズで読み出すことである。

【0088】これら受信した要求の処理を行った後、ステップS33で要求元へ応答信号を送信して、本処理ルーチン全体を終了する。

【0089】また、図10には、無線通信装置100が30における無線通信装置100の処理手順をフローチャートの形式で示している。この処理手順によれば、無線タグ・リーダー/ライタ（あるいはICカード）による無線タグ・リーダー/ライタなどの受動通信機能として振る舞いをする際に、無線タグ（あるいはICカード）などの受動通信機能の状

信号名	内容
1D識別要求	周囲の無線タグ、無線タグリーダー/ライタ装置が持つIDを取得するための要求信号。
スリープ要求	周囲の無線タグ、無線タグリーダー/ライタ装置に対してスリープ状態にさせるための要求信号。
スリープ解除要求	周囲の無線タグ、無線タグリーダー/ライタ装置に対してスリープ状態を解除させるための要求信号。
書き込み要求	周囲の無線タグ、無線タグリーダー/ライタ装置に対して情報を書き込むための要求信号。
読み出し要求	周囲の無線タグ、無線タグリーダー/ライタ装置から情報を読み出すための要求信号。

【0096】また、以下の表2には、無線タグ及び無線タグリーダー/ライタ装置で構成される無線通信装置間で使用する応答信号をまとめている。上述した本発明の実施形における無線通信装置100は、最低限、これらの50

【表2】

信号名	内容
1D識別応答	無線タグ、無線タグリーダー/ライタ装置が持つIDを要求元に返すための応答信号。
書き込み応答	無線タグ、無線タグリーダー/ライタ装置が持つ記憶領域に情報を書き込んだ結果を返すための応答信号。
読み出し応答	無線タグ、無線タグリーダー/ライタ装置が持つ記憶領域から情報を読み出した結果を返すための応答信号。

【0098】【追補】以上、特定の実施形態を参照しながら、本発明について詳しく説明してきた。しかしながら、本発明の要旨を逸脱しない範囲で当業者が修正形態の修正や改良を成し得ることは自明である。すなわち、例示という形態で本発明を開示してきたものであり、本発明の応用内容を限定的に解釈するべきではない。本発明の要旨を判断するためには、冒頭に記載した特許請求の範囲の趣意を参照すべきである。

【0099】
【発明の効果】以上詳記したように、本発明によれば、特定周波数の電波を受信したことに応答して識別情報や記憶されている情報に相当する電波を発信する動作特性を持つ無線タグを用いて非接触通信を行う、優れた無線通信装置及びその制御方法、記憶媒体、並びにコンピュータ・プログラムを提供することができる。

【0100】また、本発明によれば、無線タグ及び無線タグ・リーダー/ライタ機能の双方を装備して無線通信エリア内で好適に動作する、優れた無線通信装置及びその制御方法、記憶媒体、並びにコンピュータ・プログラムを提供することができる。

【0101】また、本発明によれば、同じ無線通信エリア内に複数の無線タグや無線タグ・リーダー/ライタ同士の干渉を防止することができる、優れた無線通信装置及びその制御方法、記憶媒体、並びにコンピュータ・プログラムを提供することができる。

【0102】本発明によれば、無線タグと、無線タグ・リーダー/ライタからなる無線通信システムにおいて、無線タグ・リーダー/ライタに無線タグと同等の機能を付加することによって、無線タグ読み書き装置自体が、他の無線タグ読み書き装置からの要求に対して無線タグとしての振る舞いをするることができる。また、外部の無線タグ・リーダー/ライタからスリープ要求を受信したときに、無線タグにおける受動的な信号送信を禁止することによって、無線タグ・リーダー/ライタにおける能動的な信号送信も禁止することにより、他の無線タグ・リーダー/ライタとの互いの要求信号の干渉を軽減することができる。

【0103】さらに、本発明によれば、無線タグと無線

タグ・リーダー/ライタ間の無線規格に特に変更を加えることなく上記の効果を得られることから、実装コストを大幅に低減することができる。

【図面の簡単な説明】
【図1】本発明を実現した無線通信エリアの様子を示した図である。

【図2】無線タグ及びリーダー/ライタの双方の機能を備えた無線通信装置100のハードウェア構成を模式的に示した図である。

【図3】無線通信部106の機能構成を模式的に示したブロック図である。

【図4】能動通信部としての無線タグ・リーダー/ライタが受動通信部としての無線タグに読み書き動作を行なう仕組みを説明するための図である。

【図5】電磁誘導に基づくICカードとICカード・リーダー/ライタの無線通信の仕組みを概念的に示した図である。

【図6】ICカードの読み書き動作をモデル化した図である。

【図7】無線通信装置100における信号受信処理動作をフローチャートの形式で示した図である。

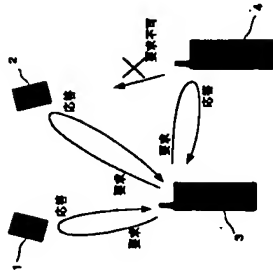
【図8】図7に示したフローチャート中のステップ9における応答受信処理の手順を示したフローチャートである。

【図9】図7に示したフローチャート中のステップ10における要求受信処理の手順を示したフローチャートである。

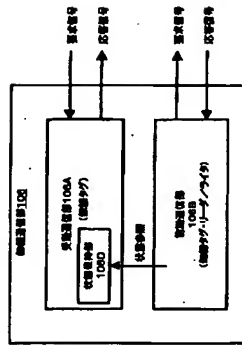
【図10】無線通信装置100が信号送信処理を行うための処理手順を示したフローチャートである。

【符号の説明】
100...無線通信装置
101...不揮発性記憶領域
102...表示部
103...CPU
104...時計記憶領域
105...入力部
106...無線通信部
107...アンテナ
108...外部インターフェース

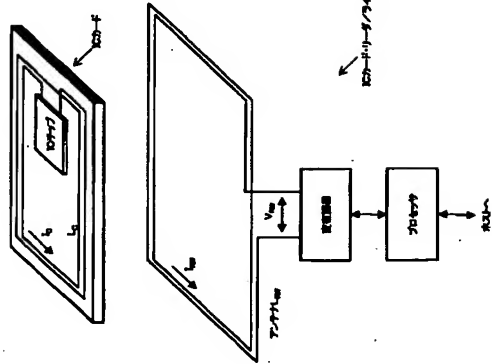
【図1】



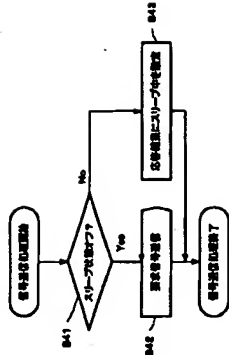
【図3】



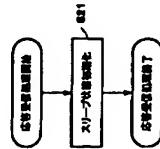
【図5】



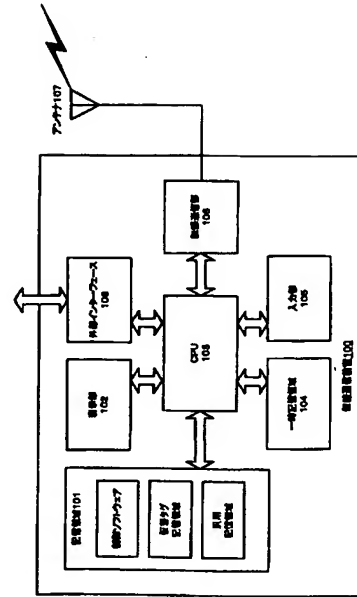
【図10】



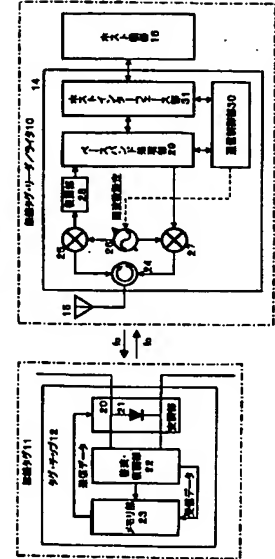
【図8】



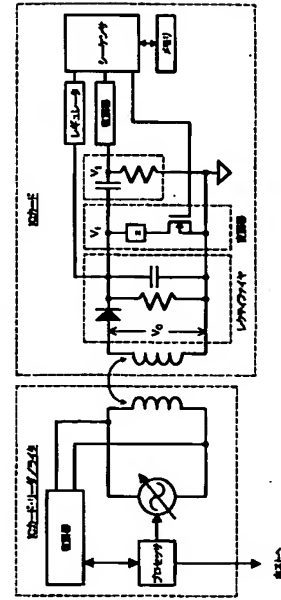
【図2】



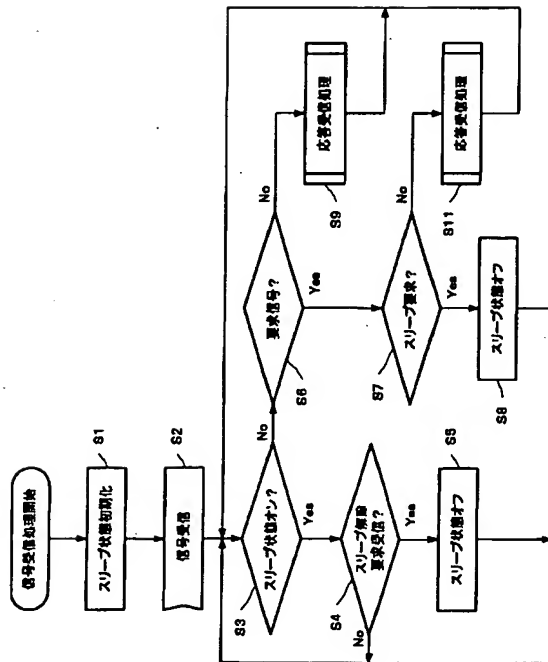
【図4】



【図6】



【図7】



【図9】

